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WORKING HOURS, WAGES, AND OUTPUT.

THERE is a particular kind of fallacy which one reads of in the study of logic, called arguing from the particular to the general. This fallacy leads the superficial thinker to imagine that he has discovered a simple and invariable law because two or three observational results happen to be in a straight line; but it is nearly always the case that the law does not hold when limiting values are approached. Even $pv/T=k$ is not true when v becomes indefinitely close to zero, and the straight-line law that the stretching of a spring is exactly proportional to the weight applied does not hold above the elastic limit.

It is never safe to apply simple straight-line law arguments to matters in which human beings are concerned. If a man can do twice as much in two hours as he can in one, we are not justified in supposing that if he gives up eating and sleeping he can do twenty-four times as much in a complete day. Yet it has been stated by at least one famous leader of industry that the work accomplished by trained technical engineers is in exact proportion to the number of hours worked. Conversely, if men are working above the fatigue-point, and a reduction of hours enables more work to be done, it is not justifiable to argue that a further reduction will increase the output in the same inverse ratio.

With regard to industrial affairs, there has been much inaccurate thinking, much slipshod administration, and much claptrap, particularly since the Armistice. At the beginning of 1919 the normal working week in the engineering industry was reduced from an average of about 53 hours, with two breaks, to a uniform level of 47 hours, with only one break. Later, Labour attempted to obtain a further reduction, to 44 hours, but in August, 1919, this proposal was withdrawn, and a joint committee, consisting of six representatives of employers and six representatives of trade unions, was set up to investigate the whole question of working hours and output.

There was a certain advantage in setting up this committee of investigation at this particular time, inasmuch as the first reduction of hours had been in operation for some time, and an opportunity was thereby afforded of ascertaining the true facts as to its effect. The argument in favour of the reduction was that 53 hours was too long, and that the men would be brighter and fresher with a 47-hour week, so that if wages were allowed to remain the same in spite of the less time worked, the employers would get the same output, and the cost per unit of finished product would not be increased. Since the cost was to remain the same, the bargain was that selling prices should not be raised, the implication being that if they were, profits would go up, and the workmen would be justified in asking for higher wages. It may be parenthetically remarked that some employers took this with a considerable grain of salt, and during the period of rising prices the notorious flexible price clause formed a means of passing on increases of cost, from whatever cause arising, to the customer. There was nothing reprehensible in this, for the money had to come from somewhere. Increased costs can only be met out of increased revenue. The inevitable result of the furious race between prices and wages was the slump, in the depths of which the industrial world is still wallowing.

The Committee, then, got to work, and it has just published a report on its investigations. In June and

July of 1920, when, so far as the electrical industry was concerned, the first signs of the slump were still three or four months off, twenty-one shipbuilding and engineering establishments were visited. In the spring of the following year the Committee visited eleven Belgian, four German, and seven Dutch works; and in August of 1921, when trade was decidedly bad, twelve places in the English Midlands came under review. The intention was that a visit should be paid to America, but it was rightly decided that in present circumstances no results of value could be thereby obtained.

It was found, as might be expected, that very much more work is accomplished when payment is by results than when it is based on time. It is a common thing to find the output doubled, and in a case where riveters were employed on a warship, it was more than quadrupled. "For a short time, until their society intervened," says the report, "shipwrights worked piecework at laying decks. It was found that output was more than doubled." In the matter of the reduction of working hours, the reduction of output was in general equal to or greater than that of the time worked.

Here we encounter an old acquaintance—the idea of the "work fund," which is responsible for ca' canny and restriction of output in general. The argument of Malthus is that population increases up to the limit of the supporting capacity of the country in which it lives, and he adduces much historical evidence in support of the view. When Malthus wrote, however, methods of transport and of cultivation were not so advanced as they are now; and even if the productive capability of England were worked to its utmost capacity (which it obviously is not) the market, being of an expanding character, would absorb the output. We do not agree with a certain well-known physicist that the remedy for shortage is birth control. If the population becomes too great to be supported here, there is ample room in other countries, such as Canada and Australia, for further development. And if, as the trade unionist so often complains, bootmakers walk the streets workless because too many boots have been made, the resulting cheapness will increase the demand, and in normal times he will soon be in work again. The supply of raw materials, such as coal, must, in the nature of things, be limited, but we have not nearly arrived at the limit yet; and the productive capacity of the world, in crops, cattle, and other living things, is capable of increase far beyond anything that has yet been accomplished. If only we could get rid of the bogey of there being only a certain limited amount of work available, so that every worker would do all he could, the resultant prosperity would be such that unemployment would become an administrative detail, and the support of workers during periods of over-production could be paid for without difficulty.

We have before now advocated some system of payment by results. Sir Lynden Macassey, in his notable book, "Labour Policy—False and True," reviewed in our columns recently, points out that the attitude of different sections of the labour world towards the idea varies considerably. Cotton operatives are universally paid by results. Carpenters and joiners call it "a pestilential system." The justification for this appellation is a little difficult to understand, though the difficulties attendant upon the variation of piece-prices consequent upon the introduction of new machinery must not be under-rated. Money that is invested must bring in a return, and while we are entirely against the notion of limitation of earnings and the vicious system of rate-cutting that has only too often been practised with that end in view, it must be admitted that the benefits derived from improvements in production ought to be shared between the employer and the consumer as well as the operative.

The more the matter is examined, the more does it become clear that only by an increase of the "will to work," on the part of all classes of the community, can the ills of the present generation be cured, and the health of the coming generations ensured.

The Therm and the Thousand.

An apologia for the therm by Sir George Beilby appeared in *The Times* of the 7th inst., the contents of which are no doubt of academic interest, but—as remarked in a leading article in *The Times* of the 9th inst.—Sir George's letter lends unconscious support to the demand for an independent inquiry into the matter. Sir George concludes his letter with these words: "The determination of the actual price to be charged for the gas supplied . . . obviously does not come within the province of the Fuel Research Board." *Verb. sap.*

Our esteemed contemporary, the *Gas World*, in a leading article a few weeks ago, put the question: "Is the therm popular?" and from the replies contributed by gas engineers and others it may reasonably be inferred that the answer to this question is decidedly in the negative. One contributor asserted that "the Gas Regulation Act was unpopular and the therm less popular; that the apathy with which the gas undertakings adopted it bore this out; and that those which had adopted it had invariably had ulterior motives." This gentleman further "ventured to say that if a power had been given to statutory gas undertakings to increase the price of gas on the 1,000 cu. ft. basis, nothing would ever have been heard about charging by therms."

It is common knowledge that gas experts are divided in their views upon the calorific value best suited to modern gas appliances and also upon the question whether the gas it may be most economical to produce will always be that which will give the consumer the greatest satisfaction. Gas of 1,000 B.th.u. (such as, according to Dr. Lander, is produced by low-temperature carbonisation) is admittedly too rich for use in existing gas appliances. Mr. George Keillor (Greenock) is a strong advocate of low B.th.u. gas, and is reported to have expressed the view that 410 gas was perfectly satisfactory, and that nothing better was needed—indeed, he is said publicly to have stated that "people who were selling anything higher were not acting with justice to the consumer." On the other hand, Mr. James Richmond (of Penycuik) avers that it is borne out in practice that gas of 500 B.th.u. is 25 per cent. better value than gas of 400.

When doctors disagree, who shall decide? It is obvious that if the consumer be charged by the therm, 500 gas will cost him 25 per cent. more than 400, and Mr. de Segundo's two questions in a recent issue of the *Gas World* are very pertinent: "Can it be expected," he asks, "that, in practice, the consumption of 500 gas in a given heater or cooker for a given duty will be 80 per cent. of that of 400 gas, and is the cost of production and distribution of 500 gas, as compared with 400 gas, fairly represented by an increase of 25 per cent. in the price per 1,000 cu. ft. which, in effect, is the result of charging per therm instead of per cubic foot?"

Clearly, unless the consumption diminishes in exact proportion to the increase in calorific value, the equivalent cost to the consumer will rise in some measure with the rise in the declared value if the charge is based upon the calorific value.

There is another aspect of the matter which should not be overlooked. Complete combustion of the gas in gas appliances is conditional upon the right proportion of air being mixed with the gas in the burners of the heater or cooker. Variations in the pressure of the gas disturb this proportion. Mr. George Keillor has published some very careful and interesting trials from which he deduces that in one case "45.4 per cent. more gas was used (for a given duty) with the tap full on than with the tap half open, with a decrease of efficiency of 5.11 per cent." But is it likely that every consumer is able to judge when the tap should be full open or half open or three-quarters? and even supposing he were, how is he to guard against the effect of variations in the pressure *at his meter*? The pressure at the consumer's meter is supposed to be about two and a-half inches of water, so that a variation in the pressure in the mains,

small in itself, might bear an appreciable relation to 2½ inches of water, and thus could materially affect the efficiency of combustion in the burners of gas appliances.

Whether a Board of Trade inquiry be the most satisfactory way of deciding the issues to which the provisions of the Gas Regulation Act have given rise is a matter upon which we will express no opinion, but it would certainly seem to be the part of wisdom for the gas companies to determine, with all convenient speed, the calorific value best suited for use in modern gas appliances and to revert to the volume basis of charge, adopting whatever calorific standard be decided upon. It will be just as easy for the proper authority to control a calorific standard as it was in the old days to control an illuminating standard. There seems little doubt that under subsisting conditions the consumer has nothing to gain and everything to lose by being charged per therm instead of per thousand cubic feet.

Salesmanship.

The first lecture of the new series arranged by the Electrical Development Association was delivered last Friday, and it demonstrated beyond argument that the E.D.A. is now a potent force in the industry.

In general, the lecture was just the type that is required if we are to make progress, and from that point of view the discussion was somewhat disappointing. Indeed, there was a tendency last year for the discussions upon the lectures to wander away from the real point, and this happened again in the case of Mr. Bush's lecture. For instance, the question of manufacturers' discounts is rather off the general question of sales campaigns, but it entered quite largely into the discussion. A great deal was said, also, as to educating the customer in the meaning of the term "foot-candles," but we are inclined to agree with Mr. Robinson, of Hackney, who said that the use of the term is all very well among those in the trade, but it is unlikely that the ordinary user of lighting appliances will bother himself about it. Certainly the private householder will not, whatever might be the case when dealing with architects and engineers in lighting large buildings. After the remarks made by Mr. Bush as to the attitude of the trade Press, it was something of a retribution for the lecturer to be told that there was a danger of the contracting people suffering from "technicalitis." Mr. Bush was left in no doubt at the meeting that those responsible for the trade Press dissented entirely from the view he put forward. It may be that Mr. Bush's comments are true of some papers, some time, but they certainly are not true of all papers, all the time, and the columns of the Electrical Review speak for themselves as to the prominence which the commercial side of the industry receives. We fancy Mr. Bush realised that his comments were a little too sweeping.

It was a wise move to take as the theme of the lecture the obtaining of new business in premises already using electricity for lighting, for there can be little doubt that many of these premises would be all the better for a thorough overhaul from every point of view. The development and pushing of new business of any class, however, is essentially a matter for combined action between the supply authorities, the manufacturers, and the contractors, and Mr. Bush was not a bit too strong in his strictures upon the lack of sales campaigns or any mildly-sustained relationship between the consumer and the supply authorities or contractors, except so far as the former is concerned, in the shape of the quarterly bill. The lack of really trained lighting salesmen is one of the strongest points made in the lecture, but that question is not so simple as it might at first appear. It would seem that development along these lines must depend more upon the supply authorities than the contractors, except in the case of the relatively few large contracting firms, for the small contractor cannot be expected to employ the type of man referred to. At the same time, knowledge of the kind indicated on the part of the man who is endeavouring to push the sales of lighting apparatus among the users is essential to real progress, and it is well that this aspect has been emphasised.

The E.P.E.A. Agreement and a Moral.

In our issue of the 6th we gave particulars of an agreement which had been entered into between the Electrical Power Engineers' Association and certain of the workmen's trade unions. The agreement is broadly to conclude an offensive and defensive alliance between the technical staffs and the workmen, so that the whole of the employés from the top down to the bottom shall be able to present a united front if trouble arises and the question of a strike comes up. One noteworthy item in the agreement is that joint action is to be taken to enforce all agreements made in the National and District Councils and Boards.

The agreement is certainly, in theory at least, one of the most important "moves" that has taken place in the industrial history of the electricity supply industry. It welds together staff and men into what is for practical purposes an *ad hoc* industrial union—and, moreover, an industrial union unique in its inclusion of all grades. The agreement is not, of course, formally complete. The E.T.U. is not in it. But we can assume that it carries the E.T.U. with it if it comes to a "scrap." Anyhow, that the E.T.U. agrees with it in principle is common knowledge.

But the agreement, crucial as it is in principle, is not of the "red flag" variety, either in letter or spirit. It is, in essence, law-abiding. In one sense, although it makes the strike-weapon more formidable, it places it in more responsible hands; by this we mean that the considered opinion of all grades combined is weightier than that of one section only. It would discountenance unofficial, irresponsible striking. But the saving grace from the employers' point of view should be that the parties are virtually pledged to observe the decisions of the Whitley Councils. That they will do this there is no reason for doubting. During the whole time the Whitley Councils have been in existence we do not remember hearing of any occasion when the *employés* have departed from any decision.

The obvious moral of all this is that the industry should stick to Whitleyism. The present scheme of Whitley Councils in operation in the electricity supply industry is unparalleled in sound and comprehensive organisation. No other industry has so secure an industrial basis. And yet there are some reactionary employers who still refuse to be persuaded as to the "good of" Whitley Councils and who seem to sigh for the good old days of rough and tumble. But one cannot put back the clock industrially in the electricity supply industry. For good or ill we have to realise that the trade union organisation of the industry is complete, and the present agreement is merely making assurance doubly sure. Destroying or weakening the Whitley Councils would not mean weakening the unions or in any way reverting to the "good old days." Quite the reverse. It would really mean that there would be combination on the side of the unions, but none on the side of the employers. Employers who think that any good can come to them this way simply do not know at first hand the present-day industrial conditions in the industry.

Finally, coming back to our original thesis, Whitley Councils are the greatest possible safeguard against strikes (and this is a point of paramount importance to an industry such as the electricity supply industry). So long as these Councils function properly the closest co-operation of the unions, by agreement, as in the present case, or otherwise, need not be viewed with disquietude. But *without* the Whitley Councils, the greater the co-operation between the unions the greater the menace. So the moral to the employers, with regard to the E.P.E.A. agreement (or anything else of this kind) is—strengthen the Whitley Councils.

THE "ELECTRICAL REVIEW" FRENCH TOUR.

In our issues of April 14th and July 21st, 1922, we gave an illustrated description of the huge power station which has been erected at Gennevilliers by the Union d'Electricité for the supply of electricity to Paris and the surrounding district, with an initial capacity of 200,000 kW and an ultimate capacity of 320,000 kW. This is, we believe, the highest rating of any steam-driven installation in the world, and the plant embodies a number of novel features in every department—from the intake on the Seine to the main transmission lines and sub-stations; hence the scheme aroused much interest in British engineering circles, in view of the national policy of concentrating generating plant in large power stations and distributing energy in bulk on a large scale.

The first impulse of an engineer when confronted with a technical problem is to say: "Let's go and have a look at it"; and realising that this feeling animated many of our compatriots, we felt that by assisting them to carry out their wish we should at the same time gratify our constant desire to render service to the electrical engineering industry. Consequently we announced our intention to organise a visit to Gennevilliers, followed by a tour embracing other interesting features.

Our proposal met with a gratifying response; applications rapidly flowed in, and the Council of the Incorporated Municipal Electrical Association gave its official support to the scheme, with the result that when over 100 applications had been received it was necessary to close the list, lest the party should become unwieldy. Owing to various causes a number of the applicants were unable to carry out their intentions, and eventually the party numbered about 70 members, *viz.*:—

A. H. Allen	Electrical Review.
F. N. R. Baker	St. Helens Corporation.
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A. W. Blake	Willesden Urban District Council.
F. A. Bond	Battersea Borough Council.
F. R. Burnett	County Borough of Barrow-in-Furness.
*H. W. Butler	Messrs. H. W. Butler & Co.
H. P. Bramwell	
E. Fowler Clark	
*J. H. Clothier	Urban District of St. Annes-on-Sea.
*Sir W. F. Coates, Bt., D.L.	Lord Mayor of Belfast.
J. Cusworth	Newcastle Electric Supply Co.
H. A. Cutler	City Surveyor (Belfast).
A. C. Cramb	County Borough of Croydon.
Boyd Dawson	Messrs. Baillee & Dobrée.
Bailie D. McK. Dewar	Glasgow Corporation.
H. W. Duckett	Metropolitan Railway.
W. F. Duffett	Rotherham Corporation.
P. Dunsheath	Messrs. W. T. Henley's Telegraph Works Co.
C. Erith	Messrs. Charles Erith & Co.
F. F. Evans	The Underfeed Stoker Co.
Councillor J. Farr	Nottingham Corporation.
F. Forrest	Birmingham Corporation.
S. Ferguson	Messrs. Ferguson & Pailin.
F. A. Garrett	Messrs. Ransomes, Sims & Jefferies.
E. A. Gatehouse	Electrical Review.
J. P. Gregory	The British Thomson-Houston Co.
*A. E. Hadley	The Victoria Falls & Transvaal Power Co.
*T. Hall	Borough of Burton-on-Trent.
*J. T. Hancock	
J. G. Harris	Assistant Town Clerk (Belfast)
B. T. Hawkins	County Borough of Wallasey.
C. F. Hewitt...	The Metropolitan - Vickers Electrical Co.
P. M. Hogg	Messrs. Pilkington Bros., St. Helens.
H. L. Howard	The General Electric Co.
J. Hornby	Borough of Hackney.
J. Hughes	County Borough of Wallasey.
W. A. Jackson	Borough of West Bromwich.
Councillor O. Jamison, J.P.	Vice Chairman (Belfast).
*L. M. Jockel	The North Metropolitan E. S. Co.
*T. A. Kingham	Borough of Kingston-upon-Thames.
F. M. Long	Norwich Corporation.
J. R. P. Lunn	Darlington Corporation.
*F. H. Mann	Messrs. Moffett, Rosher and Mann.
*H. C. McCann	The English Electric Co.
Councillor T. E. McConnell, C.B.E., M.P., J.P., Belfast.	
R. B. Mitchell	Glasgow Corporation.
F. A. Nixon	The Victoria Falls & Transvaal Power Co.
G. Pailin	Messrs. Ferguson & Pailin.
F. G. Penny	Rotherham Corporation.
F. W. Purse	County Borough of West Ham.
L. L. Robinson	Borough of Hackney.
D. A. Rickwood	Messrs. Dienny & Lucas.
Major T. Rich	
G. Riley	The British Thomson-Houston Co.
Convener R. Sadler ...	Glasgow Corporation.
C. L. S. Stewart	Borough of Rawtenstall.
H. Talbot	Nottingham Corporation.
*W. C. P. Tapper	Metropolitan Borough of Stepney.
W. G. Turner	Borough of Southampton.
G. V. Twiss	Messrs. Twiss Electrical Transmission.
*Major S. Utting	
*W. R. Whiston	The Leamington & Warwick Power Co.
G. Wilkinson	Borough of Harrogate.
T. P. Wilmshurst	County Borough of Derby.
A. E. Wilson	Messrs. Callender's Cable Co.
Johnstone Wright	County Borough of Belfast.

*Those members whose names are marked * were unable to take part in the Northern visit.

Victoria Station was the rendezvous on Friday, October 6th, and the start was made under rather unpromising weather conditions, the crossing from Dover to Calais being somewhat unpleasant; however, no one was any the worse for the short sea voyage, and a comforting meal in a roomy dining-car beguiled the time *en route* to Paris, where the party arrived before 10 p.m. Owing to the motor show, the city was very full, and it was not possible to accommodate so large a number under one roof; very comfortable quarters, however, were provided at the Hotels du Louvre, Moderne, and Montreal. After taking possession of their rooms, most of the visitors proceeded to demonstrate that the hour was not too late to sample the attractions of the "Gay City," and it is believed that they retired to rest at an early hour.

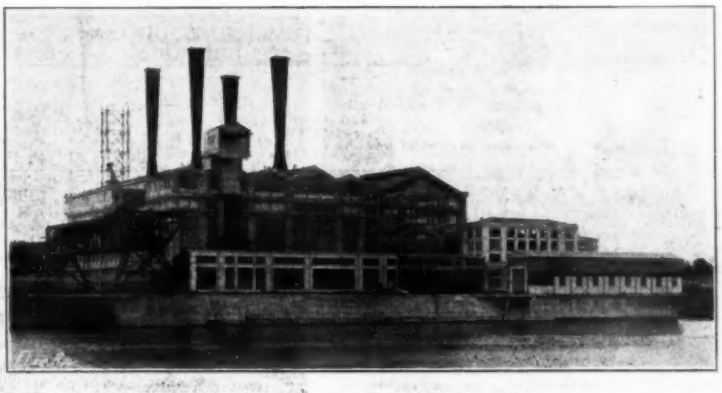
The programme for Saturday morning consisted of a visit to the military wireless station at the Eiffel Tower. The apparatus is housed in a series of underground chambers near the foot of the antennæ in the Champ de Mars, and on account of limitations of space it was necessary to divide the party into three groups, arriving successively at 9.30, 10.30 and 11.30 a.m. The visitors were received by the officer in charge of the wireless station, Commandant Jullien, who conducted them through the rooms and explained the functions of the various apparatus. The first party had the pleasure of witnessing the operation of distributing news by the musical spark system.

The equipment installed by the Military Radio Telegraphs comprises four types of sending apparatus, namely: Musical spark transmitter, 150 kW, 2,600-m. wave-length, used for broadcasting time signals, meteorological bulletins, daily news service, &c.; arc transmitter, 150 kW, 3,200-8,000 m. (usually 7,300 m.) wave-length, used for military or civil communications; high-frequency alternator, giving 20 kW in the antenna, 10,000-m. wave-length; and a three-electrode valve transmitter giving 1 kW in the antenna and used specially for wireless telephony. The principal apparatus is in duplicate, for the sake of reliability, and the necessary power can be obtained from three external sources or generated in the station. A valve transmitter giving 5 kW in the antenna is being installed.

Much interest was aroused by the special type of spark gap, the spark leaping across two gaps between three disks, which are kept continuously in motion, with an

air-blast to blow out the arc. Normally the gap is just too long for the spark to jump, but a pilot spark, controlled by relays and a Morse key, ionises the air in the gap and releases the spark. For sending by alternator a mercury turbine is used, which varies the voltage by short-circuiting a resistance in the exciting circuit of the machine.

After inspecting the station, the visitors proceeded to the Eiffel Tower and, by the courtesy of the authorities, were enabled to ascend not only to the third platform, which is open to the public, but beyond this limit to M. Eiffel's private rooms, and ultimately to the foot of the flagstaff, where there is only sufficient room for six men at a time, the last stages being negotiated with the aid of vertical ladders. We understand that M. Eiffel still pays an occasional visit to this secluded spot, whence on a fine day a view of unique interest can be obtained; unfortunately, at the time of our visit, misty weather prevailed, and the view was restricted thereby. The aerial, formerly of copper, now consists of steel cables, attached by double strings of suspension insulators to cables and electric winches on the top platform. The top of the aerial is 290 m. (951 ft.) above the ground. The six cables are spread out fanwise and anchored at the lower ends, which are insulated in the same manner, leads being brought into the underground station by way of a sunk courtyard. The visitors examined the structure of the famous tower and of the antennæ with interest, and admired the art, characteristic of our French comrades,



Gennevilliers Electricity Works.

for cooling the generators is circulated through a closed circuit, and is itself cooled by the water of condensation, thus recovering the heat liberated in the alternators; the feed water is further passed through the oil-coolers and through heaters fed with steam from turbines, heating it nearly to boiling point; the distribution pressure is 60,000 volts; the switchgear and underground cables work at this pressure; in the outer areas overhead mains are used, comprising in all 250 km. of route.

The turbo-generators were constructed by the Société Alsacienne de Constructions Mécaniques and Messrs. Schneider & Cie., the firm of Escher Wyss supplying one turbine. The boilers are of the Stirling type, built by the Compagnie Fives-Lille, with Erith Riley stokers, and the Babcock & Wilcox type, built by the S.A. des Fonderies et Ateliers de la Courneuve, with B. & W. stokers. The switchgear was constructed by the Compagnie Française Thomson-Houston.

Under the guidance of the staff officials, the visitors inspected the arrangements for handling coal and water, the generating plant and boiler-houses, and the switch-house, where they were entertained with light refreshments by the Union d'Electricité. This was a suitable moment for acknowledging the courtesy of the directors.

Sir William Coates, Lord Mayor of Belfast, in proposing the health of the company and of Col. Mercier, referred in eulogistic terms to the great kindness the company had shown to the visitors in allowing them to

Some of the Visitors at the Eiffel Tower.

The Party Arriving at Gennevilliers.

with which a huge assemblage of lattice girders was endowed with grace and lightness.

After luncheon, the whole of the members of the party assembled at the Place de la Madeleine and were conveyed in charabancs to Gennevilliers, where they were received by M. Ernest Mercier, managing director of the Union d'Electricité, and a number of engineers connected with the undertaking.

Having so recently described the works at considerable length, we need only recapitulate the particulars in brief. The five generating sets already installed are rated at 40,000 kW each, and are supplied with steam at 355 lb. per sq. in. by 15 water-tube boilers; the air

inspect the station, and congratulated it most heartily on the great progress that had already been made and on the prospects of a brilliant future which obviously lay before it. The engineers would return to their various centres profoundly impressed with the splendid future of the electricity supply industry, especially as exemplified in the power station of Gennevilliers. Those who came from the North of Ireland, forming the largest deputation from a single centre, were more especially interested owing to the fact that they were establishing a new generating station of l rge capacity for the town of Belfast and the adjoining district, and he extended a hearty invitation to Col. Mercier and the officials of the

Gennevilliers power station to be present at the opening of the new installation, which, he hoped, would take place in March next year.

The party honoured the toast with enthusiasm and hearty cheers, and Col. Mercier briefly responded to the compliment. He expressed the greatest pleasure in being able to receive the visitors and to show them what had been accomplished at Gennevilliers, and said he hoped that he and his colleagues would be able to accept the Lord Mayor's invitation to Belfast, where he felt sure they would learn much from the new plant. He then invited the party to form a group and face the camera, which was duly done, the photograph being taken on the ground level of the switch-house.

At the Royal Coach-house, Versailles.

A Group in the Trianon Park.

After this pleasant function it was announced that Col. Mercier had invited those who were so disposed to visit a new sub-station, connected with Gennevilliers power station, whilst others might inspect the switch-gear factory of the Société Française Gardy at Argenteuil. The party accordingly divided, large contingents setting out for these objectives, whilst the remainder returned direct to Paris. The drive to the sub-station, which was situated at Billancourt, on the south-west of the city, roughly followed the course of the river for a distance of some 12 miles, traversing suburbs presenting many interesting features, including overhead distribution lines alongside of the road, and passing close to the Puteaux electricity works. Approaching the sub-station, two large power stations were seen, one on either bank of the river. One of these (Billancourt), which belongs to the Union d'Electricité, was built in 1915, and contains generating plant rated at 20,000 kW, in first-class condition; perhaps no feature of the visit made so great an impression on the visitors as the fact that this fine station, barely seven years old, is to be scrapped in consequence of the erection of the new station at Gennevilliers. Many comments were heard regarding the dismay and indignation with which the proposition to scrap a seven-year-old generating station would be regarded by a British municipality—yet it cannot be doubted that the spirit of this policy is abundantly justified on technical grounds, and if a 200,000-kW power station could be erected in this country, as has been done at Gennevilliers, at a cost equivalent to 600 francs per kW installed—which will be reduced to 530 francs when the plant capacity is increased to 280,000 kW—the policy would be justified on a commercial basis also.

The sub-station provides for underground mains at 60,000 volts incoming from Gennevilliers and outgoing to other sub-stations, with three-phase transformers, and presents many interesting features. The main oil-circuit-breakers are on the floor level, and operate at 60,000 volts. The switch-house is open to the roof, skeleton construction being adopted as at the power station. The longitudinal bus bars, provided with sectionalising switches, are connected to the circuit-breakers through isolating switches fitted with a horn-break, and are on two levels with a horizontal fireproof screen between them. The transformers, in banks of three, are housed in cells having iron doors which open upon a railway, so that they can be run out directly on a trolley and removed to the adjoining repair shop. There are no instruments on the 60,000-volt mains. The pressure is reduced to 15,000 volts for distribution, and all the instruments on the secondary side are housed in a separate building, the feeders being controlled by mechanically operated oil-switches. The potential transformers are completely isolated from all other gear, so that any mishap in connection with them can be strictly localised. The 60,000-volt mains and trans-

Leaving Versailles for the Trianon.

A Wayside Halt near Malmaison.

formers are fully protected on the Merz-Price balanced-current system, a pilot wire being provided in association with the single-core cables. The two sets of 15,000-volt bus bars are separated by a vertical shield which enables work to be carried out on either set in safety while the other set is alive.

After a brief inspection of the superseded generating station, specially desired by some of the party in order to see what sort of plant was being scrapped after so short a life, the party drove back to Paris, and the members were free to pursue their own devices for the rest of the evening.

The principal feature of the programme for Sunday, October 8th, was a visit to the Palace of Versailles, whither the party was conveyed in charabancs. The weather was charming, and the excursion was thoroughly enjoyed by all who took part in it. The magnificence and beauty of the Palace and its contents were warmly admired, and the gardens, though past their prime owing to the lateness of the season, were still a mass of colour and verdure. The famous palace of Louis XIV, said to have cost 40 millions sterling, was the scene of the proclamation of William of Prussia as German Emperor in 1871, and of the signing of the Treaty of Peace in 1919.

On the outward journey the Chateau of Malmaison was visited, where numerous relics associated with Napoleon Bonaparte were inspected with interest. The Chateau was purchased in 1789 by Joséphine Beauharnais, who retired there after her divorce from Napoleon in 1809. *(To be continued.)*

THE TEXTILE MACHINERY AND ACCESSORIES EXHIBITION.

In opening the above exhibition at the City Hall, Manchester, on October 6th, Sir E. Mackay Edgar, who was supported by many leaders of the industry in Lancashire, spoke in an optimistic manner about the future of the industry. He also criticised any return to control of the industry, and indicated that in other branches of trade there was undoubtedly a progressive movement.

Although there was no complete range of textile machinery (indeed, to attempt to stage one would be a difficult task) the visitor was able to find examples of plant and appliances used in the various sections, each presenting some new and particular improvement. In a survey of the equipment displayed the foremost thought that asserted itself was that only in a few cases was there any attempt to depart from traditional practice. Refinement had been made with a view to improvement, but there had been little, if any, bold adventuring in search of new principles. Nevertheless, ingenuity was displayed in numerous ways and the persistent search for something better was evident. The trend, therefore, is to perfect what we have rather than to create something fresh.

Few exhibitions have been held in Manchester that have made a greater use of electricity than the one under review. The textile industry offers immense opportunities for electric power plant and there was, therefore, a useful suggestiveness about the exhibition, for nearly all the plant on view derived its motive power from electric motors. It is disclosing no secret to mention that several of the manufacturers of textile plant did not intend to demonstrate their machinery in motion, but when they saw what other firms were doing, they made application for power. That some were "left in the lurch" was evidenced by the fact that at two of the stands, the merits of machines were orally explained, whilst hand-written cards were suspended from the machines—"Waiting for Electric Power." The Lancashire Dynamo & Motor Co. at its stand had a 45-kilowatt set supplying electricity to no fewer than 20 stands. This plant was heavily overloaded, the percentage being as high as 60, and at the time of our visit was actually 50, and running sparklessly at that. Although erected on a wooden foundation the set was running in perfect balance. This company, in association with the Crypto Electrical Co., Ltd., of Willesden, exhibited Lancashire and Crypto a.c. and d.c. motors, Lancashire automatic centrifugal clutches, Crypto battery-charging plant and a.c. to d.c. motor generators, and a Lancashire motor-alternator set. The motor-alternator was employed to change the Corporation 400-volt d.c. supply into a.c. (400 volts, 50 periods, 3-phase) required for supplying power to many stands having a.c. motors. The switchgear for controlling the set was made by Messrs. Brook, Hirst & Co., of Chester. On another stand of the associated companies named was a range of electric motors specially suitable for driving textile machinery, including a 25-b.h.p. Lancashire pipe-ventilated squirrel-cage induction motor with a Lancashire automatic centrifugal clutch pulley; a 24-b.h.p. Lancashire protected-type, slip-ring, induction motor; a 32-b.h.p. enclosed ventilated d.c. motor, and several smaller d.c. and a.c. Crypto motors. Messrs. George Thomas and Co., Ltd., of Manchester, presented an improved portable tachometer or speed indicator for testing speeds of engines, dynamos, &c.; stationary tachometers and tachographs and transmission dynamometer or power weighing scale. Messrs. T. Broadbent & Sons, Ltd., of Huddersfield, showed a model consisting of a "Parkinson" 8-h.p. squirrel cage motor, with a "Broadbent" centrifugal clutch combined with laminated gears transmitting power to a brake drum. The model clearly demonstrated:—(1) The ease with which the motor accelerates to a predetermined speed absolutely without load. (2) The simple and positive manner in which the centrifugal clutch automatically picks up the load after the motor has accelerated. (3) The automatic slipping of the clutch in the event of an overload on the motor. The above was provided with an "Ellison" star-delta starter mounted on a pedestal along with an ammeter. Several of the roller chain manufacturers had excellent displays of their lines by showing systems of power transmission. Messrs. Hans Renold, Ltd., of Manchester, having a running exhibit driven from an overhead electric motor. Two or three B.T.H. motors were likewise employed by the Coventry Chain Co.

Messrs. Hindle, Son & Co., of Haslingden, showed electric baling presses, and examples of wireless telephone apparatus, by the Palatine Wireless Equipment Co., of Manchester. At the stand of Messrs. Ward & Co., Ltd., of Dewsbury, there was an exhibit which is an entirely new departure in the way of variable speed drives for electric motors and textile machinery.

The invention consists of an expanding pulley for a flat belt, and made its *début* at this exhibition. The whole arrangement is ingenious and the construction throughout robust.

The exhibit also includes an arrangement for fast and loose pulleys at any diameter and altogether fills a long-felt want in the textile industry.

Messrs. Hancock & Co., Ltd., of Wallington, Surrey, exhibited their newest type of electric furnace, the heat produced passing along thick longitudinal carbon rods, which are protected against oxidisation by a patent process. They are removable and replaceable in a few minutes. Demonstrations of different types of furnace work were given. A neat working model of a steam turbine specially designed for driving textile mills was erected on the stand of the Metropolitan-Vickers Electrical Co., Ltd., Manchester. The model showed a high-pressure steam turbine running at 4,500 revolutions per minute, coupled to double helical gearing, reducing the speed on the rope wheel to about 400 revolutions per minute. From the latter, ropes are taken off for driving the various floors of the mill. A comprehensive range of smaller classes of electrical plant and apparatus are staged by the General Electric Co., Ltd., for complete electrification schemes in textile mills. Lantern slides were projected by the company at its stand. The exhibits included ¼ and 1-h.p. loom motors, loom motor starting switch, a.c. and d.c. motors, desk and porthole fans, cases showing processes of manufacture of Osram lamps, examples of turbine blading, semi-portable electric drill, lighting fittings, &c. A usefully suggestive stand was that of Messrs. Mellor Bromley and Co., Ltd., of Leicester, which showed a set of electrically-heated forms for trimming hose and half-hose, electric transfer machinery for marking fabrics, and electric fabric cutting machinery. The British Thomson-Houston Co., Ltd., of Rugby, exhibited the Roxburgh control gear—a new patented device for regulating the speed of ring spinning frame motors in order to maintain a constant yarn tension; a.c. commutator motors; fractional h.p. motors and loom motors, and standard squirrel-cage induction motors; motor starting gear, including auto-transformer gear; steam flow meters; "Fabroil" silent pinions and lighting exhibits including the B.T.H. "Truetint" colour matching unit.

The exhibition, which closes to-day, was organised by the *Textile Recorder*, to which it was a "pleasurable piece of work. It has heartened us to note the variety of effort expended in bringing textile machinery to a completer state of efficiency, and it has proved to us that in every direction, either in the production of the essential machines, the provision of necessary appliances, the application of economic power generation and transmission apparatus, the textile industries of this country are most admirably served."

Absolute Zero.—The absolute zero, the lowest degree of cold, has been approached within less than one deg. This announcement was made at the meeting of the Faraday Society on October 16th by Prof. Onnes, of Leyden, Holland, who in 1908 liquified helium gas at a temperature only 4.3 deg. above absolute zero. Prof. Onnes stated that he reached a temperature of only 1.15 deg. in 1910, and that now he had lowered that figure to 0.82 deg. He had reached the limit attainable with existing processes and gases, but he felt sure that the difficulty that had arisen would be overcome.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A 4-in. Power Lathe.

A compact form of power-driven lathe is being manufactured by the Britannia Lathe and Oil Engine Co., Ltd., Britannia Works, Colchester. In this tool, as will be seen from the illustration (fig. 1), the motor is incorporated in the right-hand leg of the stand, the power being transmitted through a shaft and clutch to a spur and pinion gear. The spur is fitted to a three-speed driving wheel which transmits the power to the speed-cone of the headstock by belt. The lathe itself has centres 4¼ in. high, with a maximum distance of 25½ in. between them. Below the face-plate is a gap 4½ in. long, which enables a job 4¼ in. in diameter to be accommodated.

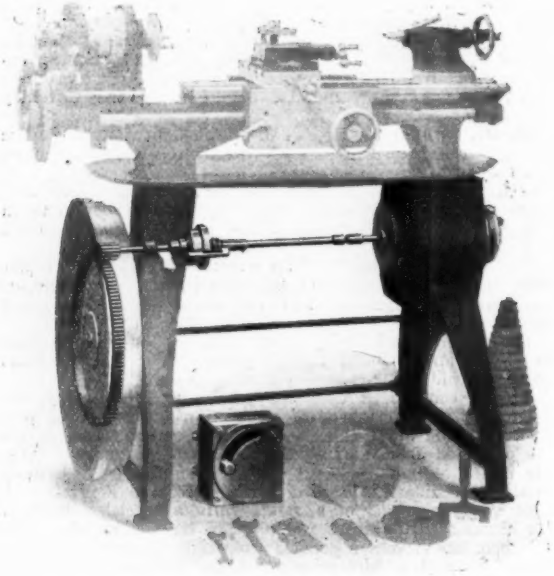


Fig. 1.—A 4-in. Power Lathe.

The headstock mandrel is mounted in roller bearings, and the back gear spindle is carried in eccentrics. The tailstock possesses an adjustment enabling it to be put out of alignment for taper turning. The slide rest is fully compound and easily removed by the unscrewing of four nuts. A number of attachments for milling, gear-cutting, boring, &c., are supplied with the lathe.

The "Unit" Time Switch.

Messrs. H. B. Turner, 79, Playford Road, N.4, have sent us a sample of their "Unit" time switch. This, we believe, is new in that it consists of an adaptation of the ordinary alarm clock. A metal frame, to which a plunger is rigidly attached, is fixed to the back frame of the clock movement. When the action of the clock reaches the release point, a pin on the alarm device raises the frame and, consequently, the plunger, pushing up the dolly of an ordinary tumbler switch mounted above the clock. The clock stands in a cast iron frame, and the switch is mounted at the back. The movement of the plunger is positive, and ample for the purpose, and the alarm can be set to within five minutes of the desired time. The makers have applied for a patent for the device.

The "Safe-economy" Iron.

With a view to ensuring safety in operation and economy of energy, the Lanston Monotype Corporation, Ltd., of 43, Fetter Lane, London, E.C.4, is about to place on the market an electric iron provided with a grip switch in the handle. Directly the handle is gripped, the switch is closed, and when the grip is released, the current is automatically switched off. Thus there is no risk of absent-mindedly leaving the iron to become red-hot and burn its way through the table. Moreover, there is a marked economy of energy; tests made at Messrs. Whiteley's laundries by Faraday House of irons in actual use on similar work showed that the one fitted with the switch handle consumed only 0.28 kWh, whilst the other took 0.46 kWh, a saving of 39.2 per cent. The switch has a quick break at four points in series, and takes up very little room.

"Heatrae" Appliances.

Among the latest designs produced by Electric Fires, Ltd., King Street, Norwich, are those illustrated in figs. 2 and 3. Fig. 2 depicts a "dog-grate" model of electric fire in which the heating elements lie horizontally, the heat being projected outwards by a polished steel reflector of suitable shape. The whole construction is of steel with the recessed parts

Fig. 2.—"Heatrae" Dog-grate Fire.

lacquered with art black and the prominent parts polished. There are three elements each of 1-kW loading and provided with a separate switch. The fire weighs 38 lb., its height is 3 ft. (approx.), its width 2 ft. 8 in., and its depth 1 ft. 2 in. The appliance shown in fig. 3 is a "utility" fire of novel design. As in the previous case, the elements are in a

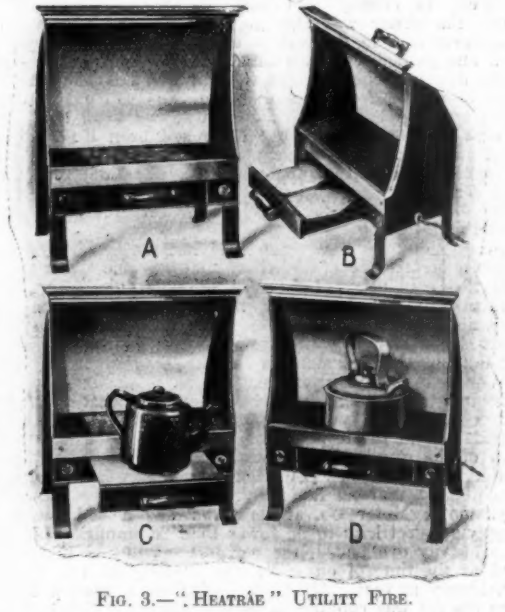


Fig. 3.—"Heatrae" Utility Fire.

horizontal plane. There are two 1-kW elements each with its own switch. The back reflector is of polished aluminium. It will be seen that the horizontal position of the elements enables the fire to be used for boiling purposes (D). In addition a trivet-toaster slides out from beneath the elements; upon this a kettle or other utensil can be placed to keep water or food warm (C). Again, the slide may be used for toasting bread by placing the slices upon it and pushing it back beneath the elements (B). The dimensions of this fire are:—Height 20 in., width 16 in., and depth 10½ in. Its weight is 14 lb.

LEGAL.

High- and Low-Voltage Lamps for Southend.

In the Shoreditch County Court, on October 12th, before Judge Cluer, Messrs. J. M. Webber & Co., Ltd., 47, Great Eastern Street, E.C., electric lamp specialists, sued Messrs. Harrisons, of 88-93, Princess Street, Southend-on-Sea, electrical engineers, to recover £19 8s. for low-voltage lamps supplied. The defence, as filed, was that the defendants had paid for them, and that they held a receipt. On the case being gone into, however, it appeared that the defence really was that the lamps had never been ordered. Mr. A. E. Robinson appeared for the plaintiffs, and the defendants appeared in person.

Mr. Morris Arthur Webber, a director of the plaintiff company, said that in August he booked an order from Harrisons, at Southend, for 500 high-voltage lamps at 10s., and 500 low-voltage lamps, at 9s. By a mistake the low-voltage lamps were invoiced at 10s., whereupon the defendant wrote and said that he had never ordered them, but if they liked to take 9s. less 5 per cent. he was willing to take them. They replied that it was by a clerical error that the lamps had been invoiced at 10s.; they should have been 9s. There was no agreement to allow 5 per cent., as the sale was at 2½ per cent. cash. This was not carried out with the high-voltage lamps, as the cheque was not sent for a fortnight or more, and 5 per cent. was deducted, of which they were now claiming back half.

Judge Cluer asked the witness why he had not got a signed order, and he replied that it offended people to ask for signatures.

In cross-examination, the witness agreed that the firms had done hundreds of pounds' worth of business together, and this was simply an unfortunate misunderstanding.

For the defence, Mr. Harrison said he never gave an order for low-voltage lamps at all, as they were useless in Southend. He had paid for all he ordered, high-voltage, and considered himself entitled to 5 per cent. discount on a 500-lamp order, which a firm did not take every day. He admitted that he could not produce an invoice of a previous transaction where he had been allowed 5 per cent.

Judge Cluer: If these low-voltage lamps were of no use to you, why offer 9s.?—Defendant: Because I could have made a profit on them in London at that price.

Judge Cluer said it was the height of absurdity for a business man to suggest that lamps were of no use to him when he could make a profit on them. As to not having given the order, he called the defendant's attention to a letter, in which he said his order was at 9s. and not 10s. He considered the plaintiffs must succeed for the full amount claimed, and entered judgment for them for £19 8s., and costs.

CORRESPONDENCE.

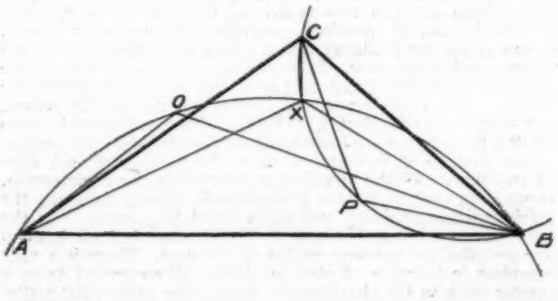
Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Calculating Currents in a Mesh-Connected Three-phase Circuit.

In the case which Mr. L. W. Schuster thinks there is no perfectly straightforward method of solving, and for which he gives a trial and error method, the following straightforward geometrical method may be of interest:—

Let the sides AB, BC, CA of the triangle ABC represent the three line currents. Assume, as Mr. Schuster does, a non-inductive load, *i.e.*, the three load currents have equal phase differences of 120 degrees.

On AB draw any triangle ABC having the angle AOB=120 degrees.



On BC draw any triangle BCP having the angle BPC = 120 degrees.

Draw circles through AOB and BCP respectively. The point X where these two circles intersect is the point which gives the three load currents AX, BX, and CX respectively. A similar construction for any other equal or unequal load power factors and consequently any unequal phase differences may be used.

Norman J. Hockley.

Manchester, *October 16th*, 1922.

Installations by Unauthorised Persons.

Referring to your very interesting paragraph from the *Melbourne Age*, it is obvious that the Melbourne Electricity Commission will not allow plumbers or other unqualified persons to carry out electrical installations. It is to be hoped that our British "Rip Van Winkles" will realise that it is high time something was done in this country to put a stop to scamped work and encourage the genuine electrical contractors. The writer has had many experiences of work carried out by "Mr. Plumber" and would feel gratified beyond measure if all plumbers and handy men were barred from interfering with electrical work. It is no exaggeration to state that a vast amount of electrical work is at present being carried out by unscrupulous persons, to the detriment of old established electrical contractors whose reputations are beyond reproach. The pity of it is, there is nothing to prevent those "Shoddy Merchants" from carrying on their nefarious work and, in fact, they seem to be encouraged by some supply authorities. The present method of most supply companies is to send an official when an installation is completed, who tests the wiring, &c., and, if satisfactory, the installation is connected to the supply company's mains. All electrical engineers will agree that a "Megger" will not disclose the secrets hidden behind walls, under floors, &c., and only time will show up the mysteries of carelessly-laid hidden cables. If supply authorities sent their officials periodically to examine electrical installations in progress scamped work would become a thing of the past and "Mr. Plumber" with his confederates would sink into oblivion.

Contractor's Foreman.

October 14th, 1922.

"How NOT to Buy."

On reading your correspondent's reply to my last letter on the above subject I immediately fell into a deep sleep; it made me feel so tired.

Luckily, however, it is not necessary for me to answer it in detail as he has not brought forward any facts to controvert my statement that the consumer of electrical goods is paying an unnecessary profit, such statements as that to the effect that a manufacturer's sales organisation will cost more than a factor's being only a dogmatic expression of erroneous opinion, not of fact.

When it comes to swapping instances, I can give him one of a manufacturer who left his selling organisation entirely to one or two wholesalers to whom he sold his whole output. Unfortunately, on the outbreak of the slump, they decided to drop him and as his goods had never gone under his own brand he had a very strenuous time until he managed to build up his own sales department. A second cousin, I heard, of the prodigal manufacturer previously mentioned, who returned to his loving factor because he couldn't get enough husks elsewhere.

Every traveller knows that a certain amount of conviviality is necessary to obtain business, and this ranges from Masonic dinners and luncheons at the Engineers' Club at one end of the scale, to a pint of bitter over the saloon bar at the other, but to suggest—or to suggest that I suggested—that all contractors' orders to factors are vows made in wine is absurd.

Your correspondent's reference to Eastcheap is not particularly happy as I spent four years of my business life there and could probably cap his list of food factors—Kelly's Directory could beat us both at that—but that does not alter the fact that the tendency among food producers is to cut out the wholesaler.

As to the personal part of the business, your correspondent is very much out in his suggestion that I am a disgruntled manufacturer's inside man, and as it appears to be my turn to show—in my opponent's practical fashion—my appreciation of the advertising value of the Electrical Review "Correspondence" column, I will mention that I am, in theatrical parlance, "resting."

Walter Shandy.

October 16th, 1922.

Labour Policy: False and True.

In your article on Sir Lynden Macassey's book you mention the fact that the E.P.E.A. is the only staff union that has set seriously about improving the lot of its members.

It is undoubtedly true that the E.P.E.A. has done a lot for many of its members, but there is a tremendous lot still left undone. Recently I visited a friend who is charge engineer at a 20,000-kW station. The watch-office was like a dog's kennel. No bathroom, a very feeble apology for a wash-hand basin, a rough wooden table, one broken-down kitchen chair, and paltry little lockers not large enough to contain a change of clothes and barely large enough to accommodate the few technical works of reference, &c., that

most engineers like to keep by them. The salary, attained after three years' service, at present "cost-of-living" rates is £353 by E.P.E.A. schedule—this for the entire responsibility of something like a million pounds' worth of delicate, complicated interconnected plant for eight hours a day, six days a week. The holidays, after a year in that vile atmosphere, generally at a temperature "not fit for a white man to work in," with that nerve-racking responsibility and that constant nerve-racking noise (probably, if all the subconscious truth were known, the most wearing factor of all), the holidays are 14 days, rising one day per year to a maximum of 21 days. Just the same as any office man doing 38 hours a week and never a night out of bed. If the four charge engineers were raised to Grade 5, E.P.E.A. schedule, the total cost would be £400, about .002 of a penny per unit sold. The cost of an additional charge engineer, by means of whom it would be possible to run six-hour shifts, would mean another .0021 of a penny. And it is more than probable that the added vigilance that shorter hours, better conditions and more pay would enable a man to maintain, would result in at least .01 of a penny being knocked off the costs. Power-station engineering is now an advanced science, and, as one authority has recently said, "the price of efficiency is eternal vigilance"; and the very high degree of mental vigilance necessary to the man who takes charge of a modern power station cannot possibly be maintained for long hours without a break in a vitiated atmosphere. Anyway, salaries are such a small item in the total cost of most stations that if they were doubled or halved there would not be any very material difference in the profit or loss. A glance at the records of most stations shows that they are making handsome profits, and, as a correspondent in your columns recently pointed out, there is, in most cases, no real reason for any reductions at all. In fact, most stations with the highest salaries cost show the most profits. For instance, Liverpool, with salaries at .21d. shows £146,964 profit; Manchester, at .11d., only shows £44,564; Leeds, at .14d. shows £26,891; Sheffield, at .07d., only £11,824; Glasgow, at .13d., shows £161,576; Birmingham, at .07d., only £68,161. Among smaller stations, Tunbridge Wells, at .53d., shows £7,465, while Swansea, at .14d., shows a loss of £3,866—and it serves them jolly well right! It must be quite obvious to the meanest intellect (and some power station authorities are pretty mean!) that the one secret of success in station work is to keep the salaries factor very high.

Anyway, the alleged cost of living reductions are getting about the limit, and it is about time the E.P.E.A. called a halt.

Welfare.

October 15th, 1922.

The Status of the Electrical Contractor.

Is it any worse for a "painter and paperhanger" to take charge of a colliery plant than for a hot-water and sanitary-engineer to paint on his signboard "Electrical Contractor"?

Why is it considered right and proper for a contractor—electrical or otherwise—to act as a consulting engineer, but wrong and improper for the latter to take contracts?

Consultant.

London, *October 15th*, 1922.

Estimating for Internal Wiring Contracts.

In the correspondence that has arisen from my article entitled "Estimating for Internal Wiring Contracts," which appeared in your issue of September 1st, there is a general expression of opinion that the existing methods of obtaining estimates for internal wiring contracts are unsatisfactory.

The recognition of this fact is a first step in the right direction; logically, the next step is to explore all possible avenues leading to ultimate improvement of such faulty methods.

It was with this aim in view that the writer submitted his suggestions for the adoption of "Electrical Bills of Quantities," in conjunction with specification and plans, as an improved means of obtaining tenders.

"Lodestone," in your issue of the 6th instant, agrees that "bills of quantities satisfy quality and quantity," but continues with a non-contentious assertion that bills of quantities do not eliminate the need of specification and supervision.

Properly prepared bills of quantities, preferably in the form of "spot" bills, with an abstracted summary for pricing, give the following definite advantages:—

(1) Actual amounts of material included in the contract are given.
(2) Quality of material is specified.
(3) Disposition of materials is indicated.
(4) Schedule of rates usable for variations is provided.
(5) Measuring up and taking off of quantities is carried out by the surveyor only, in lieu of each contractor tendering.
(6) The client obtains an absolutely reliable index to the items of expenditure.

The writer has not touched upon all the points raised by your correspondents owing to their irrelevant nature.

Alan Kirk.

London, S.W.1,
October 16th, 1922.

The British Society of Engineers.

Referring to the "Institution Notes" in your issue of May 19th, 1922, *re* the British Society of Engineers, we should like to obtain the views of your readers on the value of the diploma which this society awards, we understand, by examination. Perhaps some one could enlighten us as to the activities of this society, and the advantages obtained by being a member.

Students (Electrical).

October 12th, 1922.

Electricity Supply Problems.

An interesting situation has arisen in a certain Sussex town, in which an electricity supply company has completed an agreement with the local Council for supplying the town with electricity. Apparently, one of the clauses is to the effect that a Provisional Order would be applied for at once, but this has not been done, and the company is either refusing point blank to connect, or charging a fee of £10 for connecting houses where the wiring has been done by outside contractors, the grounds of its action being that the Council gave it this right. Even the contractors living in the parish are barred from doing wiring work in their own town.

It seems as though the Council has been "had" and is powerless to act, as it does not move in the matter. Probably, when the supply company has forced as many people as possible to have the wiring carried out at its own price and on its own terms, at a "take it or leave it" penalty, it will apply for a Provisional Order for a bigger area.

Now there is a group of persons who do not intend to be treated in this way, and would rather club together for a plant of their own (the rest of the town being too apathetic to move). The doubtful points are these:—

(1) Can they pay for the running of the plant by meter?
(2) Can their wires cross a main road (from house to house)?
(3) How will they stand when the supply company gets a Provisional Order?
(4) Has the Council powers to grant a monopoly (without a Board of Trade order) either outside or inside owners' houses, such as is claimed at present?

It is of interest to find that a similar concern is being promoted in a district in Kent, and it is to be hoped that the local authorities concerned will keep awake, or their juice "will cost them more."

A Lost Unit.

[Provisional Orders have been replaced by "Special Orders," granted by the Electricity Commissioners, whose consent, by the way, must be obtained before any plant for public supply is established. (1) Yes. (2) Yes, if wayleaves are obtained from the house-owners or tenants, and the Electricity Commissioners' Rules are complied with. (3) The supply company cannot interfere, if the private group's operations are carried out before the Special Order is obtained. (4) No.—Eds. Elec. Rev.]

Do Motors "Go Bad"?—In the letter on p. 538 of our last issue, line 2 from foot of first column should commence with the word "not."

An Electrically-equipped Liner.—A special feature of the *Volendam*, a large Holland-America liner, built by Messrs. Harland & Wolff at their Govan shipyard, and which has run successful trials, is the electrical installation. There are four generating sets, each capable of giving 2,270 A at 110 V. In addition to these, there is an emergency Diesel engine direct-coupled to a dynamo, situated aft above the water line, capable of supplying 680 A at 100 V. There are over 2,200 lights distributed throughout the passenger accommodation and machinery spaces, some of those in the engine room and for working cargo having an illuminating capacity of 1,000 c.p. There are two motors driving the steering gear, either of which can, if required, provide the necessary power. There is also an auxiliary motor which takes the place of the more usual hand gear. The windlass, capstans, and all the winches, including those operating the boats, are electrically driven. The first-class rooms, including the public rooms, are supplied with electric radiators. The water-tight doors on the tank tops are all operated electrically from the bridge, where there is an indicator to show the position of each door at any time. All the auxiliary machinery in the engine-room, comprising over 30 motors, is electrically driven, including the refrigerating machinery and main circulating pumps. In the boiler-rooms Messrs. Harland & Wolff's electrical oil igniters are installed for lighting up the oil burners. There is a very complete installation of electric clocks, all controlled from a master clock in the chart-room. Among the other electrically-driven apparatus are potato peelers, dish washers, dough mixer, ice-cream machine, egg mixer, meat chopper, coffee mill, knife cleaners, ash hoist, fire extinguishers, and also hot plates and hot-water boilers, as well as two electrically-driven pantry hoists.

BUSINESS NOTES.

The "Electrical Review" Jubilee.—With the issue of this journal dated November 17th we shall complete fifty years' publication, the Review having been started on November 15th, 1872. This jubilee issue will be very much larger than our ordinary weekly number, and a considerable part of it will have to go to press early. That being so, we desire to draw the attention of advertisers to the announcement which is made in our advertising pages to-day. The possible space is strictly limited and the scheme has to be closed promptly.

Bankruptcy Proceedings.—Wm. Reginald James White, electrical agent, late of Golden House, 29, Great Pulteney Street, W.—The first meeting of creditors under this failure was held last week at the London Bankruptcy Court, a receiving order having been made on the petition of a creditor on September 28th. Mr. Walter Boyle, Official Receiver, reported that it appeared from the debtor's statements that for some twenty years prior to September, 1920, he held a commission in the Forces, and then retired with a gratuity of £3,300. He became partner in an electrical business, carried on at 29, Great Pulteney Street, W., under the style of "Dent & White," paying £200 for a one-half share, and introducing £300 as capital. The partnership was merely verbal and no capital was found by the partner who retired six months later. The debtor was joined shortly afterwards by another partner, who paid £500 for a one-half share of the business and £50 as premium. The business was continued under the style of "White & Dayrell" until the partner resigned last May. The firm was then quite solvent and the late partner left his capital in the business on condition that he should be released from all liabilities. The debtor was subsequently joined by another partner who was given a one-sixth share in consideration of services rendered. The business was now being carried on as electrical agents and factors, and the debtor attributed his failure to losses on investments. The case was left in the hands of the Official Receiver. The accounts showing liabilities of £1,150 against assets £45 gross and 10s. net.

S. H. Dougherty (Mersey Electric Co.), electrical engineer, Liverpool.—Trustee, Mr. H. W. Bowler, 30, North John Street, Liverpool, released September 6th.

H. A. Depledge, electrical engineer, 53, Frodingham Road, Scunthorpe.—Last day for proofs for dividend, October 28th. Trustee: Mr. S. M. Forrester, 1, Town Hall Street, Grimsby.

F. J. Martland (F. Martland & Co.), electrical engineer, Albion Yard, Millgate, Wigan.—Last day for proofs for dividend, October 28th. Trustee: Mr. E. D. Symond, Official Receiver, 11, Dale Street, Liverpool.

G. F. Coupe, electrical engineer, 2, Spring Gardens, Stockport.—The first and final dividend of 10d. in the £ payable October 23rd, at the Official Receiver's Offices, Byrom Street, Manchester.

Charles Johnson Haxby and Edward Brady, trading as Haxby & Brady, 1a, East Parade, Harrogate, electrical engineers.—The first meeting of the creditors of the above was held on October 16th at the Court House, Harrogate. The statement of affairs showed gross liabilities of £538, of which £508 was expected to rank, against net assets of £314, or a deficiency of £194. Debtors attributed their failure to insufficient capital, keen competition, bad debts, and law costs. The case being a summary one was left in the hands of the Official Receiver as trustee.

The following are creditors:—

	£		£
Albion Electric Stores	29	Fox, W. Dundas	20
Baxendale & Co., Ltd.	14	Morley, T. B., & Co., Ltd. ...	11
Chadwick, E.	32	Russell, J., & Co., Ltd.	15
Shanks, D., & Co., Ltd.	11	English Electric & Siemens Supplies Co., Ltd.	29
Electric & General Stores, Ltd.	83	New Italian Art Association, Ltd.	10
Electric Engineering & Equipment Co., Ltd.	11	Wilson, Hartnell & Co., Ltd. ...	16
Edison Swan Electric Co., Ltd.	22	Parr, Harold	10
Falk, Stadelmann & Co., Ltd. ...	27		

George William Humphry, trading as Humphry Electric Co., 24, Broad Quay, Bristol, electrical engineer.—The receiving order in this matter was made on October 3rd, on debtor's own petition. The statement of affairs shows liabilities of £467, while the assets are estimated to realise £339. The net assets are £311, or a deficiency of £156. Debtor attributes his failure to bad trade, loss of capital of £68 invested in Farrow's Bank, Ltd., and depreciation of shares for £500 invested in an electrical company. It appears that after being employed as an electrical engineer until 1905, he took a course of technical training, and in 1911 commenced as a consulting engineer. In 1914 he obtained an engineering appointment, which he had to give up in March, 1915, on account of ill health. In 1917 he commenced business as an electrical engineer as the Electrical Repair Co. His capital consisted of £30 in cash, but in addition he had two houses of the value of £600. In 1919 he removed to 25, Warwick Road, Baptist Mills, Bristol. In April, 1920, he was appointed a director and engineer of a company at Avonmouth, and until December, 1920, he was employed in purchasing the necessary machinery and carrying out the work of installation of the company. He states it was his intention to form his own business into a limited liability company, and in December, 1920, he removed his stock and plant to Avonmouth, but the negotiations fell through. In March last he removed to his present address. He became aware of his position in February, 1921.

Company Liquidation.—John Brotherton, Ltd., Wolverhampton.—A meeting of the creditors of the above was held at the Victoria Hotel, Wolverhampton, recently, when it was reported that the company had gone into voluntary liquidation, with Mr. M. Wilkie, C.A., of 22, Darlington Street, Wolverhampton, as liquidator. It was stated that he, as receiver, had offered the business for sale as a going concern, but it had not been disposed of. The present position was attributed to the slump in trade which followed the armistice, and heavy loss on the realisation of the stock. In answer to a question, the receiver stated that it did not appear that there would be a very substantial dividend for the unsecured creditors, and he was in negotiation for the sale of the business privately. It was decided to confirm the voluntary liquidation of the company with Mr. Wilkie as liquidator.

Dissolutions of Partnership.—T. W. Craig & Co., electrical engineers, 3, Church Road, Waterloo, Lancs.—Messrs. T. W. Craig and E. H. Wells have dissolved partnership. Debts will be attended to by Mr. R. T. Goulding, chartered accountant, 41, North John Street, Liverpool.

Lee & Bufton, electrical engineers, Fornham Street, Sheffield.—Messrs. H. Bufton, W. Marples, and C. Marples have dissolved partnership. Debts will be attended to by Messrs. H. Bufton and W. Marples, who will continue the business.

Trade Announcements.—Messrs. Rice, Wilson & Herd, of Johannesburg, dissolved partnership on September 30th. Mr. F. Peabody Rice and Mr. C. Diethelm then entered into partnership as Rice & Diethelm, Ltd., with offices at Standard Bank Chambers, Johannesburg, where they represent a number of well-known electrical manufacturers. Messrs. C. E. Wilson and Philip Herd have formed a firm under the style of Wilson & Herd, with head office at Johannesburg (Standard Bank Chambers), and a branch office at Cape Town (3, Waterkant Street). They will represent a different group of equally well-known British electrical manufacturers.

Mr. John Brunton, of 28-30, Lime Street, London, E.C.3, has been appointed agent for the Universal Bolts & Nuts, Ltd., of Old Hill, Birmingham, suppliers of bolts and nuts for telegraph and telephone ironwork and other purposes. Illustrated leaflets have been issued.

Owing to increased business in the Liverpool branch area Messrs. W. T. Henley's Telegraph Works Co., Ltd., have taken larger premises at 37-41, Duke Street, Liverpool, and all communications should now be sent there instead of to Whitechapel. Larger stocks of wires and cables and other manufactures will be carried. New telephone number: "Liverpool, Royal 790."

Messrs. Hobdell, Way & Co., Ltd., engineering merchants, &c., have removed from St. John's House to 45, Church Street, Minories, London, E.1. The new warehouse address is Haydon Square, Minories, E.1. Larger stocks will be carried and the insulating and asbestos departments extended.

Catalogues and Lists.—Alloy Welding Processes, Ltd., 14-16, Church Street, N.1.—A pamphlet describing electrodes for the welding of non-ferrous metals.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. Leaflet No. X2828.—A list of reduced catalogue prices of low and medium-pressure switchgear.

The Relay Automatic Telephone Co., Ltd., Marconi House, Strand, W.C.2.—A booklet describing the "Relay" system, and containing letters of appreciation from clients, and illustrations of buildings in which the system is installed.

Electric Fires, Ltd., King Street, Norwich.—September list of electric fires. Fully illustrated and priced.

Messrs. Archibald J. Wright, Ltd., 395, City Road, E.C.1.—An illustrated price list of electric pocket lamps, torches, and electrical novelties.

Messrs. Evershed & Vignoles, Ltd., Acton Lane Works, Chiswick, W.4.—List No. 154, illustrated and priced, being a full description of the "Meg" insulation tester, a new product of the firm.

Radio Instruments, Ltd., 12, Hyde Street, Oxford Street, W.1.—An illustrated price list of wireless apparatus of all kinds.

Ironclad Switchgear Co., Ltd. (Eccles), 23, Queen Anne's Gate, S.W.1.—A mailing card advertising the firm's switch and fuse gear.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4.—A series of pamphlets, &c., dealing with "Mazda" lamps, "X-Ray" reflectors, and "Keldon" and "Ace" lighting units.

The Selson Engineering Co., Ltd., 83-85, Queen Victoria Street, E.C.4.—Catalogue No. 114, giving numerous illustrations and particulars of braiding machines, cable and wire-rope machinery, &c.

Lanston Monotype Corporation, Ltd., 43, Fetter Lane, E.C.4.—An illustrated pamphlet describing an electric iron fitted with a grip switch in the handle.

The Mullard Radio Valve Co., Ltd., 35a, Claybrooke Road, W.6.—A showeard illustrating, in colours, examples of the firm's wireless apparatus.

Messrs. John Musgrave & Sons, Ltd., Globe Iron Works, Bolton.—A treatise upon the design, installation, and maintenance of the "Radojet" air pump. The publication is fully illustrated by means of diagrams and photographic views, and the capabilities of various sizes of "Radojet" pumps are given in tabular form.

Messrs. Greenly's, Ltd., 37 and 38, Strand, W.C.2.—"Greenly's Ghost," a little magazine dealing with the firm's publicity organisation.

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—List No. 375, illustrating and describing "Sunco" switch boxes for recessing into walls, &c. Also a folder advertising "Sunco" electric fires. Both publications are priced.

Mr. Frederick Tuckett, 87, The Grove, Hammersmith, W.6.—An illustrated catalogue of shades for electric light pendants, standards, &c., together with a net trade price list.

The English Electric Co., Ltd., Queen's House, Kingsway, W.C.2.—Price List 2110, containing illustrations, details, and prices of ironclad oil-break switch pillars of various types.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, E.C.2.—Publication W.L. 4, giving details, illustrations, and prices of "Isco" 30- and 60-A single-pole cut-outs.

Messrs. Herbert Kennedy & Co., Ltd., 47, Victoria Street, S.W.1.—Illustrated booklet describing the "Electroscope," a new optical-mechanical device, which visually slows the motion of mechanisms, so that their functioning can be observed, and also enables production to be speeded up.

Sterling Telephone & Electric Co., Ltd., 210-212, Tottenham Court Road, W.1.—Twelfth addition of general catalogue (151 pp.) dealing in a comprehensive manner with the company's products—telephones, switchboards, bells, indicators, batteries, wires, mine exploders, &c. Fully illustrated and priced.

The Jeary Electrical Co., Ltd., 8, Lambeth Hill, Queen Victoria Street, E.C.4.—Catalogue Q 1922, giving illustrations and prices of crystal and valve wireless receiving sets, components, and accessories.

Messrs. Casey, Bean & Cassells, 63, Queen Victoria Street, E.C.4.—List No. 822, a pamphlet dealing with the "Super improved rim friction clutch. Profusely illustrated by examples of applications.

Expanding Pulley & Electric Co., Thornhill Lees, Dewsbury.—An illustrated folder describing a motor-driven expanding pulley set.

Our Foreign Trade.—September Figures.—The following were the values of imports and exports of electrical goods and machinery during September, 1922:—

	Sept. 1922.	Inc. or dec.	Inc. or dec. 9 months 1922.
Imports.—	£	£	£
Electrical goods and apparatus	129,488	+ 5,775	− 570,744
Machinery	623,222	+ 76,491	− 3,035,118
Exports.—			
Electrical goods and apparatus	524,142	−400,625	− 5,247,233
Machinery	4,280,692	−917,225	−19,792,512
Re-exports.—			
Electrical goods and apparatus	7,525	− 6,082	− 52,305
Machinery	99,086	− 5,491	− 184,081

Local Exhibition.—An electrical exhibition, in which a number of leading firms will participate, is to be held at Villa Marina, Isle of Man, from October 25th to November 6th. This will be of some importance in view of the scheme of electricity supply now being carried out by the Douglas Town Council.

A New Power House in Gloucestershire.—In September last the Electricity Commissioners issued a sanction to the Norchard Syndicate, Ltd., for the erection of a power house to supply a delimited area in Gloucestershire. We are informed that the name of the company has been changed to the West Gloucestershire Power Co., Ltd., the capital of which is being increased to £235,000, with necessary borrowing powers, and that work has been started on the erection of the power house at Lydney, which is designed for an ultimate capacity of 30,000 kW, of which 10,000 kW is already on order. It is expected that the whole of the power available will be absorbed very rapidly, as a large amount is required for the collieries and for industrial purposes over the area of supply, which is 300 square miles. We understand that the contractors are The Foundation Co., Ltd., who have undertaken that current will be available early next year. The contract is a comprehensive one, including the distribution system throughout the area. The contractors state that they will not require any addition to their staff.

Electrical Enterprises in Japan.—Japanese electrical supply companies would seem to be prospering in contrast with other classes of undertakings, due, in part, to the progress made in the amalgamation of various companies.

According to the returns published by the authorities, the generating power showed an increase of 40,000 kW during the first half of last year over the corresponding period of the preceding year, and an increase of 81,000 kW during the first half of the current year over the corresponding period of the preceding year.—*Reuter's Trade Service* (Tokio).

Boiler Manufacture in Sweden.—*Dagens Nyheter* learns from Gothenburg that the Goetevorkon shipyards have taken over the rights of manufacturing and selling Babcock & Wilcox boilers in Sweden. These rights were previously held by the Hunktell engineering works.—*Reuter's Trade Service* (Stockholm).

French Companies.—Fibrett Mica is the style of a company formed with a capital of 1,000,000 fr., for the manufacture and sale of all kinds of electrical insulators. Its offices are at Villeurbanne (Rhône). The company is an off-shoot of the Compagnie Electro-Mécanique, from whom it takes over certain assets.

La Compagnie Française d'Applications Electriques is the name of a new undertaking which has lately been formed in Paris (168, Rue du Faubourg, St. Honorè), with a capital of 100,000 francs.

Lead.—In their report dated October 14th, Messrs. James Forster & Co. state:—"There has been a considerable demand from consumers this week for November and December delivery, but for spot or near lead, fortunately, they appear to be comfortable. No doubt consumption is increasing—the building trade is much more healthy and electrical cable work is better. The Board of Trade returns for September show: Imports 17,030 tons, exports 1,373 tons, leaving for home consumption 15,657 tons."

Book Notices.—We have received a copy of the October edition of "The Buff Book," published by Business Telephone Directories, Ltd., of 25, Lawrence Lane, E.C., which contains, in addition to the usual classified lists of London traders and London professional classes, alphabetically arranged, a Hotel section, which gives the names of the principal hotels in the British Isles, the Continent, Egypt, &c.

Faraday House Journal.—The Michaelmas term number, Vol. X, No. 1, of this well-known house organ, in addition to the usual notes and notices of interest to Faradians, contains an article by Mr. C. I. Walker, on "Boiler Feed, and its Influence on the Economic Performance of Boiler Plant," while the subject of "The Application of Electric Traction to Industry," is dealt with by Mr. A. D. M. Eaton.

"Working Diagrams of Valve Receiving Circuits" (21 diagrams). London: Radio Instruments, Ltd. Price 1s.—These diagrams show simple forms of valve receiving circuits not usually included in text-books. Special arrangements for "broadcasting" reception are embodied in the booklet.

"Electric Drive in Textile Mills" (Descriptive List No. 640A). Rugby: The British Thomson-Houston Co., Ltd.—This is a well-produced brochure in which are set out the advantages of the electrical driving of textile machinery, the methods of installing motors, and other relevant details. The publication is profusely illustrated with clear photographic views of installations, &c.

"Post Office Electrical Engineers' Journal." Vol. 15; part 3. October, 1922. London: The Electrical Review, Ltd. Price 2s. net.

British Trade Mark Applications.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Firms desiring to enter an objection to any of the applications have one month in which to do so from the dates mentioned below. In the case of foreign firms, the address in this country to which objections are to be sent is also stated:

Radion. No. 427,065. Class 40. Electric insulating materials of hard rubber and vulcanite. The American Hard Rubber Co., 11, Mercer Street, New York, U.S.A. (Haseltine, Lake & Co., 28, Southampton Buildings, London, W.C.). October 11th, 1922.

Broadco. No. 427,612. Class 8. Telephone, telegraph and wireless apparatus, and components. Gordon O. Tutton, trading as the Broadcast Wireless Co., 2, Tower Royal, Cannon Street, London, E.C. October 11th, 1922.

Ethophonola. No. 128,250. Class 8. Self-contained receivers and sound-diffusing apparatus for wireless telephony. Burndept, Ltd., Ariel Works, Blackheath, S.E.3. October 11th, 1922.

Sunray. No. 424,577. Class 13. Incandescent electric lamps (ordinary). The Harland Engineering Co., 196, Greengate, Manchester. October 11th, 1922.

For Sale.—Darwen Corporation Electricity Department has for disposal one 150-kW d.c. Belliss-Siemens steam dynamo, with spare armature, condenser, valves, and steam piping, &c.—Belfast Corporation Tramways Department invites offers for 2,000 tons (approx.) of old rails, crossings, fishplates, &c. (See our advertisement columns to-day.)

Tuition in Traffic Problems.—We have received from the National Traffic College (Royal Liver Buildings, Liverpool) a pamphlet relating to two courses of instruction which have been prepared for the assistance of those responsible for or interested in the transportation questions of trade and industry. The courses deal respectively with "The Science of Industrial Traffic Management," and "The Art of Shipping Goods Abroad." They are prepared by those who have had very lengthy practical experience in traffic management. The pamphlet sets forth the lists of subjects covered in the two courses. In addition to the correspondence tuition thus provided, the student is also helped with his day-to-day problems in the position that he fills with the firm or authority employing him.

Siemens & Halske.—The 75th year of the existence of the Siemens & Halske undertaking was celebrated in Berlin on October 12th, the concern having been formed in 1847 by Werner Siemens & J. G. Halske, as a telegraph manufacturing business. In 1897 the firm was converted into a joint-stock company, and the number of persons employed, together with those of the Siemens-Schuckert Works, is stated to be close on 100,000 at the present time.

Swansea Electrical Exhibition.—After a most successful run the Corporation Electrical Exhibition closed on Saturday evening. Mr. Hodge, of the British Thomson-Houston Co., Ltd., on behalf of the exhibitors generally, presented the Borough Electrical Engineer and Mrs. J. W. Burt with a handsome standard electric lamp, and Mr. and Mrs. Harvey Davies with an electric coffee percolator. In handing over the gifts Mr. Hodge commented upon the excellence of the general arrangements, and declared it was one of the pleasantest exhibitions with which he had ever been associated. He added that the exhibitors were well satisfied with results. In acknowledgment Mr. Burt said that he was delighted to know that the exhibitors were well satisfied with the orders received. It was a great satisfaction to him to know that over 25,000 people had visited the exhibition. That was a number he had not dared to anticipate. As to expenses, these, so far as could be judged, had been met, but the exhibition was intended to educate the public into the greater uses of electricity rather than to make profits.

New Belgian Company.—There has been formed at Brussels (Rue du Frône, 91) the Etablissements Industriels G. Landare, for the installation, sale, and manufacture of electrical apparatus, and especially of that for heating and lighting. Capital 500,000 fr.

Proposed Belgian Electrical Exhibition.—The scheme to hold an international electrical exhibition in Brussels in 1925 has not been wholly abandoned, as has been supposed in some quarters. It is true that the Comité Central Industrial has pronounced against it, but the Chambre Syndicale des Electriciens Belges and other organisations interested in the electrical industry have not yet expressed their opinions on the subject, and, says *L'Electricité pour Tous*, nothing definite can be assumed until they do so.

Costing.—On November 2nd, Lord Leverhulme, president of the Institute of Cost and Works Accountants, will address a public meeting to be held in Manchester under the auspices of the Manchester and District Branch of the Institute, on "Human Factor Influence on Costs." The Lord Mayor of Manchester will preside. Tickets can be obtained from the hon. secretary of the Manchester and District Branch of the Institute of Cost and Works Accountants, Mr. F. Ewing, F.C.W.A., 232, Stockport Road, Cheadle Heath, Stockport.

LIGHTING AND POWER NOTES.

Abergavenny.—Electricity Supply.—The Town Council has under consideration a proposal to supply the town with electricity.

Australia.—New South Wales.—The Minister for Works has under consideration, states the *Sydney Daily Telegraph*, an important proposal for the establishment of a State Electricity Commission, on the lines of the body which is developing the Victorian brown coal area at Morwell. The establishment of schemes at Burrinjuck and on the North Coast of the State are in contemplation, and a large amount of data has been collected by the Public Works Department with regard to hydro-electric energy. Various bodies in the south-west of New South Wales are urging the Government to proceed with the Burrinjuck project, which will cost approximately £350,000. It is also stated in Sydney that the Railway Commissioners have tentatively decided to proceed with the big scheme for a power station, either in or near the town of Lithgow. In the course of a letter to the Blaxland Shire Council, the Secretary to the Commissioners, said that it was proposed to lay down a plant that would to a great extent meet the demand for lighting and power throughout a large area of the western district.—*Reuter's Trade Service* (Melbourne).

Aylesbury.—Wiring Scheme.—The Town Council has adopted an "assisted" wiring scheme for houses. The wiring is to be left in the hands of local contractors provided that their charges do not exceed £1 per point.

Birkenhead.—Special Order.—The Town Council has applied to the Electricity Commissioners for a Special Order extending the area of supply to the Urban Districts of Bebington and Bromborough.

Chester.—Purchase of Plant.—The Electricity Committee has recommended that the plant at Queensferry be purchased for £54,000, and that application be made to the Electricity Commissioners for sanction to borrow that amount. On completion of the purchase of this plant, the Committee recommends that two additional transformers and switchgear be obtained at a cost of £6,000, and pumping plant at a cost of £1,500.

China.—South Manchuria.—H.M. Consul at Dairen reports that the South Manchurian Railway Co. proposes to expend about 30,000,000 yen (£3,250,000), upon new developments. This will include 2,007,881 yen for electrical works, such as the extension of the third power station at Antung and the Changchau works. The company's supply system will be enlarged, and the tramway system in Dairen extended.

Cirencester.—Fire at Electricity Works.—Damage estimated at several thousands of pounds was caused on Friday last by a fire at the electricity works. The cause of the outbreak has not yet been ascertained. The power station was a practically new building, was equipped with some of the most up-to-date machinery. There were several sets of generators and batteries at the works, and two of them are totally disabled. Thanks to the promptitude of the local fire brigade, a practically new set was saved. The staff was able to remove a quantity of inflammable oils from the zone of the fire, and so avoid explosions and greater conflagration. The lighting service was partially restored on Saturday, and for use in the churches on Sunday.

Clevedon.—Application for Order.—The North Somerset Electric Supply Co. has applied to the Electricity Commissioners for an order enabling it to supply electricity to the district by overhead wires.

Continental.—France.—According to a recent publication of the French Ministry of Public Works the power of the hydro-electric stations installed at the present time in France totals about 2,100,000 h.p., sub-divided as follows: Lighting, small motive power, and heating, 650,000 h.p.; industrial motive power, electrochemistry, and electro-metallurgy, 1,300,000 h.p.; electric traction, 50,000 h.p.; agriculture and sundry, 100,000 h.p. At the end of the war, the total installed power amounted to 1,500,000 h.p. The latest figures consequently show an increase of 40 per cent. The power of stations now under construction and expected to be finished within two years from date, may be estimated at about 300,000 h.p.

The Conseil Général of the *département* of Eure-et-Loir has taken in hand a large scheme of electrification affecting some 350 communes. A distribution network of 165 km is projected, to be fed from an existing generating station at Aube in the neighbouring *département* of the Orne, calculated to furnish 5,500 kVA, of which 5,500 kVA will be allotted to agricultural purposes. The scheme is estimated to cost about 40,000,000 fr., and private installations about the same amount.

Dalton-in-Furness. — Electricity Supply. — The Urban Council has asked the Barrow-in-Furness Town Council to extend its area of supply so as to include the whole of the Urban District, with charges the same as those ruling at Barrow.

Ealing.—Price Reduction.—The electricity charges have been reduced from 9d. to 8d. per kWh for lighting, and from 3d. to 2½d. per kWh for power.

East Lothian.—Electricity Scheme.—The chairman of the County Council has reported that the Council has been in touch with the Musselburgh Electric Light and Traction Co., and a scheme has been formulated, whereby a new company will be formed to deal with the electricity supply for the whole county. Mr. Cownie, managing director of the Musselburgh Company, is willing to undertake this, provided that a bulk supply can be obtained from Edinburgh Corporation on reasonable terms.

Halifax.—Year's Working.—The accounts of the municipal electricity undertaking (engineer: Mr. W. M. Rogerson) for the year ended March 31st last show that the total revenue was £169,383, comparing with £182,998 in the preceding year. The working expenses amounted to £105,393, as against £126,983, leaving a gross balance of £63,990 (£56,015). After crediting interest on investments (£3,247) and deducting capital charges (£46,776), the net result was a profit of £20,461, which was slightly in advance of the previous year's profit of £20,124. This was transferred to the appropriation account together with other credits. Against this total was charged a deficit of £31,052 from the previous account, capital and other special expenditure amounting to £22,774, and other charges, totalling £39,230, leaving a deficit, carried to the balance sheet, of £37,674. The total expenditure on capital account was £88,936. This

included items of £34,059 and £15,671 in respect of a 10,000-kW turbo-alternator set, and £15,778 for mains and services. The energy sold was 15,797,312 kWh, as compared with 18,521,577 kWh in 1920-21. The total costs per kWh sold rose from 2.110d. to 2.263d., although the actual generating cost was reduced from 1.645d. to 1.601d. per kWh.

Hastings.—Price Reductions.—The Town Council has adopted the following revised scale of charges per kWh for electricity: General lighting, 7.8d., as against 6½d. pre-war rate; arc lighting, 5.4d. as against 4½d.; power and heating, 2.4d., as against 2d. Consumers whose accounts at 7.8d. amount to £100 and upwards are to be allowed 25 per cent. discount for electricity consumed up to March 31st next.

Horwich.—Special Order.—The Urban District Council is applying to the Electricity Commissioners for authority to generate and distribute electricity for all purposes within the district.

India.—Punjab.—*Indian Engineering* reports that at a meeting of the Punjab Electricity Board earlier in the year it was resolved that the Government should create a monopoly for generating electricity from the rivers and canals of the province, and for supplying energy in bulk. The Subera Hydro-Electric & Agricultural Development Association was asked to undertake the development of the water power on the understanding that any profit made in excess of 11 per cent. (including 3 per cent. for depreciation) should be divided in the proportion of one quarter to the association and three-quarters to consumers in the form of reduced rates.

Gazipur.—The Government of the United Provinces is prepared to grant a licence in accordance with the provisions of the Indian Electricity Act, 1910, for the electrification of the town.—*Reuter's Trade Service.*

Burma.—According to *Indian Engineering* an extensive scheme is in contemplation for supplying electricity to Burma. It is proposed to divert the waters of the Yunzalin river down a slope and through tunnels, thereby supplying the motive power for the generation of electricity for transmission to Rangoon.

Inverness.—Hydro-Electric Scheme.—Sir W. G. Armstrong, Whitworth & Co. are preparing a hydro-electric scheme in connection with the Caledonian Canal. They will submit the complete scheme to the Town Council in three weeks.

Liverpool.—Special Order.—Notice is given that the Electricity Commissioners have made a Special Order under the Electricity (Supply) Acts 1882-1922, for confirmation by the Minister of Transport authorising the Corporation to supply electrical energy for public and private purposes within the county borough of Bootle and the urban districts of Litherland, Waterloo-with-Seaforth, and Great Crosby.

Llandaff and Dinas Powis.—Special Order.—The Rural Council has applied to the Electricity Commissioners for a Special Order to revoke the Llandaff & Dinas Powis Electric Lighting Orders, 1901 and 1908, to annul the deed of transfer between the Council and the Radyr Electric Co., Ltd., and to authorise the Council to purchase the undertaking of the company, and to generate and distribute electrical energy within the parish of Radyr.

London.—St. Pancras.—The Council is applying to the Electricity Commissioners for sanction to the extension of the switchboard at the King's Road station at an estimated cost of £15,000-£16,000. Tenders are to be called for on receipt of this sanction.

Nelson.—New Plant.—On October 12th new turbo-generating plant was officially started up by the chairman of the Electricity Committee in the presence of a large gathering of officials and visitors. The plant is of the Brush-Ljungstrom type, and we hope to publish further particulars next week.

New Zealand. — Hydro-Electric Development. — The Minister of Public Works recently stated that tenders would shortly be invited for work in connection with the duplication of the tunnel of the Lake Coleridge power station.—*Reuter's Trade Service* (Melbourne).

Northampton.—Special Order.—The Northampton Electric Light & Power Co., Ltd., has applied to the Electricity Commissioners for powers to extend its area of supply to the parishes of Mears Ashby, Ecton, Sywell, Earls Barton, and Overstone.

Radcliffe.—Electricity in Bulk.—The Council is to cease generating electricity and the station is to be converted into a distributing and transforming centre. The Lancashire Electric Power Co., Ltd., will supply electricity in bulk, but the Council will retain its rights under the original Provisional Order.

Rathmines (Dublin).—Lighting Scheme.—The Urban Council has applied to the Free State Provisional Government for sanction to loans amounting to £10,000 in connection with a scheme for lighting the district with electricity.

Rye.—Electricity Supply.—The Town Council has referred to the Lighting Committee an application by Mr. E. D. Sharkey and Messrs. Crompton & Co., Ltd., for permission to lay mains in the town for the supply of electricity.

Wimbledon.—Price Reductions.—The electricity department has published a schedule of reduced tariffs which is to take effect as from the September meter readings. The new charges are as follows:—Lighting (flat rate), 7d. per kWh. Cooking and heating, 1½d. per kWh. Power (tariff "A"), 2d. per kWh, flat rate; tariff "B," 2d. per kWh for consumptions of 250 kWh or less per h.p. per quarter, graduated downwards by .10d. per kWh for each extra 50 kWh consumed, to a limit of 1.25d. per kWh for a consumption of 550 kWh or above; tariff "C," a flat rate of 1½d. per kWh provided that energy is not taken at certain stated periods of heavy load (this involves an extra charge for the rent of a time switch).

Yarmouth.—New Plant.—In order to meet the increasing demand for electricity the Town Council is installing new plant at a cost of £17,800.

TRAMWAY AND RAILWAY NOTES.

Australia.—Victoria.—Considerable public alarm was caused by a recent occurrence on the Mordialloc line of the Victorian State Railways. An electric train failed to stop at a scheduled station, and, gathering speed, crashed through some level-crossing gates and passed another station at a speed of about 50 miles per hour. It was eventually brought to a stop by the application of the brakes by the guard. It was found that the driver was missing, and his body was discovered some miles away. The train should have been stopped automatically by the release of the operating handle, but it was stated that the handle was found to be tied up in its "on" position. An inquiry was to be held.

Bristol.—Control of Tramways.—By a two-thirds majority the City Council has decided against taking over the control of the tramways.

Continental.—France.—The Paris-Orleans Railway Co. has placed an order with the Westinghouse Electric and Manufacturing Co. for the equipment of 120 electric locomotives. The order was placed through the Compagnie Electro-Mécanique, which had been commissioned to supply the electro-pneumatic equipment of these locomotives.

Italy.—A concession has been granted to the Società Anonima Industriale Ferroviaria for the construction of an electric railway from Bribano to Sedico and Agordo. The cost of the construction and equipment of the line is estimated at 9,458,897 lire.

An electric railway from Domodossola to the Italian border is to be constructed by the Società Subalpina di Imprese Ferroviaria at a cost of 11,243,397 lire. The line is to be completed by the end of 1923.

Switzerland.—According to a report of the general management of the Swiss Federal Railways, 357 km. has been electrified up to the present. During 1923 and 1924 electrification work will be concluded on 239 km. By the autumn of 1924 877 km., or about one-third of the Federal network, is to be electrified. The electrification of these lines will cost nearly 350,000,000 fr., to which 128,000,000 fr. must be added for rolling stock, making the total amount 478,000,000 fr., of which 300,000,000 fr. will be paid by the end of this year. Of the 178,000,000 fr. to be paid between 1923 and 1926, 50,000,000 fr. is for electric locomotives. The coal saved on the lines electrified up to the end of 1926 will amount to 318,000 tons yearly, *i.e.*, 45.4 per cent. of the Federal Railway's total consumption of coal in 1913.—*Reuter's Trade Service* (Zurich).

Halifax.—Year's Working.—The total revenue during the year ended March 31st last of the Corporation's tramway undertaking (manager: Mr. B. Hall) was £226,769, as compared with £229,743 in 1920-21. Expenditure upon revenue account totalled £198,292, as against £208,191, leaving a gross balance of £28,477 (£21,552). After crediting £2,912, interest on investments, and debiting capital charges amounting to £28,559, a net profit of £2,830 remained; this compared favourably with a deficit of £618 in the previous year. The deficiency on appropriation account increased from £10,875 to £13,755. The motor omnibus and trackless trolley accounts showed deficits of £172 and £405 respectively. The expenditure upon capital account amounted to £37,437, including over £32,000 for reconstruction of track. An amount of £2,565 was provided out of revenue for the purchase of land and the execution of certain works. The number of passengers carried fell from 23,823,406 to 20,799,660, and the car-mileage from 2,168,338 to 2,032,652.

Hull.—Penny Fares.—The Town Council has confirmed a proposal of the Tramways Committee to restore penny stages on the tramway system.

Japan.—Tokio Underground Railway.—*Eastern Engineering* states that the Tokio Underground Railway Co. is to commence operations early in the coming year, and the work is expected to be completed by the end of 1925. An expenditure of 189,000,000 yen (£20,475,000) is involved.

Leeds.—New Route.—The work of connecting the tramway at Halton with Templenewsam Park is to be carried out with the approval of the Light Railway Commissioners, confirmed by an Order. The connection will be upon a raised track.

West Hartlepool.—Railless Cars.—The Town Council has decided to provide railless cars on the Foggy Furze tramway route as far as the borough boundary, at an approximate cost of £9,600.

TELEGRAPH AND TELEPHONE NOTES.

Chile.—Wireless Telephony.—According to the United States Commercial Attaché at Santiago (Chile), it seems probable that before long serious consideration will be given to the development of wireless telephony in Chile. Legislation is contemplated, based on the laws of the United States, and although it will not provide specifically for the establishment of broadcasting stations by private enterprise, it is possible that such a service will be available through the leasing of Government-owned stations during times of peace.

China.—New Telephone Exchange.—According to the Government Bureau of Information, Republic of China, the Tientsin Telephone Administration has made plans to install a telephone exchange at Tangshan (Chihli). A site at Nansiaoshan has been selected for the erection of the office. Work will soon be commenced.

France.—Telegraph and Telephone Extensions.—It has been decided to reorganise and strengthen the telegraph and telephone service in the Lyons district, and two new stations are to be constructed. One, in the Place Ampère at Lyons, is in course of construction, and 300,000 fr. will be expended on it in the course of the current year. An outlay of several million francs is to be provided for in 1923. New telephone circuits are also to be set up in the department (Rhône), giving further facilities of communication between Lyons and Paris, Strasburg, Marseilles, and other important cities.

Mexico.—Wireless Telephony.—The installation of a wireless telephone service to operate between various important centres in Mexico is being contemplated, says the *Financial Times*.

The Telephone Service.—Year's Work.—In a speech at Bedford on October 12th, Mr. Kellaway, the Postmaster-General, gave an account of the work of the Post Office, and referred to the prospects for the future. The department was, the *Daily Telegraph* reports him as saying, as a whole now on a self-supporting basis, and there was every indication that the anticipation that the current year's working would show a surplus would be realised. The increase in the Post Office revenue had principally been due to an increase in telephone revenue. This side of the Post Office work was increasing in a highly satisfactory manner. There were now 1,007,000 telephone stations in the country. Although the proportion of private subscribers to the whole service was still only 23 per cent., there was unmistakable evidence that private individuals were acquiring the telephone habit. The work of laying the trunk cables underground was going on rapidly. In all about £2,250,000 was being devoted to underground trunk extension work this year, and a further £500,000 to other trunk work. The total expenditure of the department this year on telephone development of one kind and another would amount to more than £9,000,000.

United States.—Large Wireless Valves.—The *Daily Mail* announces that the Rocky Point, Long Island, wireless station of the Radio Corporation of America successfully maintained communication by means of vacuum tubes across the Atlantic for 16 hours on October 15th. The message continues: "It was the first commercial test of the 50-kW siner tube, recently invented by Dr. Irving Langmuir, research engineer of the General Electric Co. Four tubes replaced the Alexanderson alternator. The tubes, which were water cooled, were actuated at 15,000 volts."

Wireless on Tanks.—The successful adaptation of the wireless telephone for use in tanks is announced by the U.S. Army Ordnance Department, which is about to give a demonstration of the new engines of war it has produced since the war. As part of the programme, a fleet of tanks will manœuvre under the wireless orders of its commander in a flagship tank.—*The Times*.

Wireless Telephony.—Broadcasting.—In the course of his recent speech at Bedford, Mr. Kellaway, the Postmaster-General, said that if they succeeded in starting this new form of communication in this country on really sound lines, no one would regret the delay. A beginning would probably be made in London and Manchester. The seven other stations which were to cover the country would, he hoped, be ready for working in the course of three or four months. The company could not be allowed to take the property of the Press and the Press agencies, and he would see that these interests were properly protected in any arrangement made by the Broadcasting Co.

Rules for Fixing Aerials.—The Bradford Health Committee has established the following conditions and regulations in respect of the installation of wireless apparatus in houses in Corporation housing sites:—(1) A licence must be issued by the Postmaster-General; (2) no poles or aerials are to be fixed in the gardens at the front or sides of the houses; (3) all poles and aerials are to be fixed to the satisfaction of the city architect; (4) all damage done to the premises is to be made good from time to time, and upon removal of the apparatus, as required by the city architect and to his satisfaction, at the tenant's expense; and (5) all apparatus is to be removed when required by the Corporation and within seven days from the receipt of notice.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Aberdeen. — November 10th. Electricity Department. One 10,000-kW turbo-alternator, with surface condenser and auxiliaries. (See this issue.)

Australia.—Melbourne.—November 21st. Postmaster-General's Department. Telephone switchboard parts.*
November 16th. Insulated signal cable (Sched. 958).
November 21st. Switchboard parts (Sched. 67).
December 12th. 1,416 switchboards (Sched. V68).
January 10th, 1923. Telegraph power plant (Sched. W.A. 647). (See this issue.)
November 29th. Victorian Railways. One industrial electric storage battery truck (4,000 lb. carrying capacity).*
Victorian Railways. January 24th, 1923. Fifty miles insulated copper wire.—*Reuter's Trade Service* (Melbourne).
January 19th, 1923. Electricity Commissioners. Steam turbine-driven boiler-feed pumps (Spec. 23/4) for the Morwell power scheme. (See this issue.)

Belgium.—November 11th. Municipal authorities of Oostham, Province of Limburg. Establishment of an electricity distribution system in the town.
November 4th. Municipal authorities of Saint-Gilles-lez-Bruxelles. Cast-iron terminal boxes, with circuit breaker, and also a number of junction boxes.

Birmingham.—November 27th. Electric Supply Department. E.h.p. switch panels, &c. (See this issue.)

Bristol.—November 14th. Electricity Department. One 4,000-kVA single-phase turbo-alternator with condensing plant. (See this issue.)

Dublin.—November 6th. Irish Postmaster-General's Department. 14,000 Leclanché cells, 3,500 dry cells, 8 tons chloride of ammonia, 40,000 Leclanché zinc rods, 3,500 Leclanché glass cells. (October 13th.)
October 23rd. Electricity and Public Lighting Committee. E.h.p. switchgear and accessories, &c. City electrical engineer, Fleet Street, Dublin.

Edinburgh.—November 1st. Tramways Department. Supply, &c., of one 20/25 h.p. motor tower wagon. Tramways manager, 2, St. James's Square, Edinburgh.
November 14th. Tramways Department. Eight automatic point controllers and 56 top-covered car bodies. The manager, Tramways Department.

Egypt.—Alexandria.—December 20th. Administration of Ports and Lighthouses. Eight travelling electric portico quay cranes, eight travelling balcony cranes, eight electric lifts, rails, &c.*
Cairo.—October 30th. Egyptian State Railways. Direct-coupled steam engine and alternator, switchboard, &c., for the power house, Gabbary, Alexandria.*

Glasgow.—October 28th. Parish Council and District Board of Control. General contracts, including electric lamps and electric fittings for six months. M. A. Reynard, inspector and clerk.

India.—October 24th. Great Indian Peninsula Railway. Supply of electric incandescent lamps. Mr. R. H. Walpole, secretary, 48, Copthall Avenue, E.C.
November 3rd. High Commissioner for India. Electric jib crane and overhead electric crane. Director-General, Stores Department, 11, Belvedere Road, S.E.

Leeds.—November 10th. Electricity Department. Iron castings for 6 or 12 months. (See this issue.)

London.—London County Council.—November 6th. Control panel and switchgear connections for No. 4 generator at Greenwich power station. (October 13th.)

Manchester.—October 24th. Tramways Department. Electric goods cage lift. Mr. H. Mattinson, general manager, 55, Piccadilly, Manchester.

October 25th. Education Committee. Electric lighting installations at Seymour Road, Clayton, and Mansfield Street, Ardwick, municipal schools. Specification from the Education Offices, Deansgate, Manchester.

Neath.—Rural District Council Electricity Department. One 1,000-kW turbo-alternator, with condensing plant, foundations, switchgear, &c. (October 13th.)

New Zealand.—WELLINGTON.—November 28th. Public Works Tender Board. Two exciter transformers for the Waikato power scheme.*

December 5th. Telephone system for the Mangahao power house and sub-stations, &c.*

DUNEDIN.—December 8th. City Council. One 150-h.p. 3-phase motor and reduction gear for the Mornington cable tramway system.*

Porth.—October 23rd. Rhondda Urban District Council Electricity Department. One 100-kVA, 3-phase static transformer. (October 13th.)

Rochdale.—November 1st. Board of Guardians. Electric lift, &c., at Birch Hill, Dearnley. (October 13th.)

Romford.—October 22nd. Board of Guardians. Electric lighting installation at the hospital. Mr. R. H. Mason, clerk to the Guardians, The Institution, Romford.

South Africa.—JOHANNESBURG.—November 16th. Municipal Council. Four or more double-deck tramcar bodies or four or more single-deck ditto, 15 or more double-deck bogie tramcars, complete with truck and electrical equipment, 15 single-deck ditto, complete, 28 gear wheels.*

PRETORIA.—November 23rd. Municipal Council. H.p. and l.p. switchgear, transformers, and cables in connection with the extensions of the electric light and power supply.*

South Shields.—November 15th. Electricity Department. Two water-tube boilers with mechanical stokers, economisers, induced draught plant, and steel chimney, also ash-handling plant and extension to boiler-house. (See this issue.)

Torquay.—November 4th. Electricity Department. E.h.p. switchgear for Newton Abbot power station and main sub-station at Torquay. (See this issue.)

Warrington.—November 13th. Electricity Department. H. and l.p. paper and lead-covered cable. (See this issue.)

Wicklow.—November 4th. Urban District Council. Semi-Diesel engines and dynamos, booster, switchboard battery, overhead mains, house services. Messrs. J. P. Tierney and Co., consulting engineers, 44, Kildare Street, Dublin.

*A copy of the plan, specification, and conditions of tender, &c., can be inspected at the Department of Overseas Trade (Room 84), 35, Old Queen Street, S.W.1.

CLOSED.

Argentina.—BUENOS AIRES.—Water works. Extension of the pumping plant, including one generating station and eight transformer sub-stations, one filtered water station and two river water stations.

	Filtered water station.	River water stations.	Generating plant and eight transf'r sub-stations.	Total.
Brown-Boveri (Cia. Sudam de Elect.)	132,450.00 o/s.		685,800.00	903,850.00
	131,650.00	115,600.00	707,600.00	950,550.00
	147,250.00	111,300.00	751,300.00	
	146,400.00	c.i.f. 10 months.		
Vickers, Percy Grant and Co.	168,860.00	83,046.00	683,740.00	935,646.00
	c.i.f. 21 weeks.	c.i.f. 21 weeks.	Begin in 21 weeks. and terminate in 40.	Valid for 60 days.
Siemens Schuckert ...	120,000.00	113,000.00	753,000.00	986,000.00
	132,000.00	113,000.00	764,400.00	1,009,400.00
Siemens Schuckert*	190,512.50	111,305.00	741,705.00	983,522.50
Anglo-Arg. General Electric Co., Ltd....	139,650.00	99,200.00	756,650.00	995,500.00
Gebr. Stork & Co. ...	208,047.00 Without electrical equipment.		787,721.00 10 to 16 months.†	995,768.00
A.E.G.	172,000.00	83,000.00	763,800.00	1,018,800.00
	10 to 12 months.	10 to 12 months.	10 to 12 months.	
Soc. Anon. Tecnica y Comercial (Sulzer)	128,750.00	119,600.00	776,820.00	1,025,170.00
	119,237.00	108,247.00	760,820.00	988,304.00
	120,087.00	115,300.00	798,620.00	1,033,957.00
	162,020.00	94,949.00	817,923.00	1,074,892.00
Schneider & Cía. ...	15 to 20 months.	11 to 17 months.	12 to 17 months.	
S. F. K., Stockholm...				1,120,020.00
G. E. Co. of America	149,700.00	153,200.00	929,300.00	1,232,200.00
			812,000.00	
			816,000.00	1,114,900.00
Simpson (Agar, Cross and Co., Ltd.)	171,404.00	142,865.00	962,190.00	1,276,459.00
			969,660.00	
			928,160.00	
Westinghouse, U.S.A.	301,205.00	301,205.00	813,258.00	1,415,668.00
	9 months.	9 months.	9 months.	1,867,470.00
Franco Tosi, Bertuletti, V. y. Cía. ...	no offers.	no offers.	530,000.00	

* Additional bid for payment of not less than $50,000 Arg. gold.
† With electrical equipment for pumping stations.

—*Review of the River Plate.*

Australia.—MELBOURNE.—Victorian Government.
400 miles steel-cored aluminium cable (£10,250).—British Aluminium Co., Ltd.

Melbourne and Metropolitan Board of Works.
Two electrical centrifugal pumping plants (capacity 12 million gallons daily each) (£11,761).—Messrs. G. E. Kelly & Lewis Pty., Ltd.—

ORANGE (N.S.W.).—Municipal Council.
Electric generating plant and machinery (£7,000).—Australian General Electric Co.—*Reuter's Trade Service* (Melbourne).

Belgium.—The Société Leodal, of Schaerbeek, submitted the lowest tender last week to the municipal authorities of Schaerbeek, Brussels, for the supply of 500 5-amp. single-phase electricity meters. The prices quoted by the eight competing firms ranged from 39 fr. 30 centimes to 56 fr. per meter.

Birmingham.—Board of Guardians. Tenders have been accepted from the following firms for the X-ray and electrical apparatus and massage appliances required for the new ward at Dudley Road Hospital, at a cost of about £4,000:—Cox Cavendish Electrical Co., Ltd.; Watson & Sons (Electro-Medical), Ltd.; Newton & Wright, Ltd.; A. E. Dean and Co.; X-Rays, Ltd.; Schall & Sons, Ltd.

London.—LONDON COUNTY COUNCIL.—Asylum and Mental Deficiency Committee. Eleventh Mental Hospital Epsom. Electric wiring installation for the buildings, motors, &c.:—

D. Henderson	£8,700
Higgs & Hill, Ltd. (accepted)	**9,476**
Marryat & Place	9,690
T. Clarke & Co.	10,498
Brightside Foundry & Eng Co., Ltd.	10,500
Western Eng. Co., Ltd.	10,560
F. Craft, Ltd.	11,117
Electrical Installations, Ltd.	12,334
Alpha Manufacturing Co.	12,489
Malcolm & Allan, Ltd.	12,960
J. R. Dunkley & Co.	13,187
Tyler & Freeman	13,600
H. J. Cash & Co., Ltd.	14,039
G. E. Taylor & Co.	14,360
Cox Walkers, Ltd.	14,394
Pinching & Walton	14,432
G. N. Haden & Sons, Ltd.	15,179
R. Houchin	16,012
Glumart, Cox & Co.	Incomplete.

The name of Mr. D. Henderson, of Glasgow, who submitted the lowest tender, is not on the King's National Roll. The Committee has, with the concurrence of the General Purposes Committee, accepted the tender, amounting to £9,476, of Higgs & Hill, Ltd.

Supplying and fixing overhead electrical conductors, &c.:—

Malcolm & Allan, Ltd.	£6,590
Cox Walkers, Ltd. (accepted)	**7,573**
Tyler & Freeman	8,020
Higgs & Hill, Ltd.	8,166
Electrical Installations, Ltd.	8,905
W. T. Henley's Telegraph Works Co., Ltd.	9,426
G. E. Taylor & Co.	9,674
Callender's Cable & Construction Co., Ltd.	9,683
Pinching & Walton	9,702
Alpha Manufacturing Co.	9,860
Marryat & Place	10,230
Haden & Sons, Ltd.	10,639
R. Houchin	10,911
Western Electric Co., Ltd.	11,628
Siemens Bros. & Co., Ltd.	11,907
Johnson & Phillips, Ltd.	12,260
T. Clarke & Co., Ltd.	12,300
J. R. Dunkley & Co.	16,143

The lowest tender, submitted by Malcolm & Allan, Ltd., was based on a misunderstanding, and has been withdrawn by the firm. The Committee has, with the concurrence of the General Purposes Committee, accepted the tender, amounting to £7,573, of Cox Walkers, Ltd.

Education Committee. Accepted:—
Renewing electric storage battery at the Avery Hill Training College (£370).—Pritchett & Gold and E.P.S. Co., Ltd.

Staffordshire.—The Staffordshire, Wolverhampton, and Dudley Joint Committee for Tuberculosis. Accepted:—
Electric wiring and fittings in connection with the new administrative block at Prestwood.—Messrs. Manley & Regulus, Ltd.

Sunderland.—Corporation. Accepted:—
L.p. cables.—Pirelli-General Cable Works, Ltd.; British Insulated and Helsby Cables, Ltd.
Feeder pillars.—Henley's Telegraph Works Co., Ltd.
Manhole frames and covers.—Ballantine & Sons, Ltd.
Creosoted redwood capping and casing.—Jos. Thompson & Co.

FORTHCOMING EVENTS.

Edinburgh Electrical Society.—Saturday, October 21st. At 3.15 p.m. Visit to Brunton's Wire Works.
Friday, October 27th. At the Philosophical Institute. At 8 p.m. Paper on "Fault Localisation," by Mr. D. M. Buist.

Institution of Electrical Engineers (North-Eastern Centre).—Monday, October 23rd. At Armstrong College, Newcastle-on-Tyne. At 7.15 p.m. Inaugural address by the chairman, Mr. F. G. C. Baldwin.
IRISH CENTRE, DUBLIN.—Thursday, October 26th. Inaugural address by the Chairman, Mr. E. C. H. Handcock.

Chemical Society.—Thursday, October 26th. At the Institution of Mechanical Engineers, Storey's Gate, S.W. At 8 p.m. Lecture by Sir W. H. Bragg, F.R.S., and Prof. W. L. Bragg, F.R.S.

Chelmsford Engineering Society.—Thursday, October 26th. At the East Anglian Institute of Agriculture. At 7 p.m. Paper on "Modern Oil Engines," by Mr. W. A. Tookey.

Junior Institution of Engineers.—Friday, October 27th. At 39, Victoria Street, Westminster, S.W. At 7.30 p.m. Questions and general discussion.

Birmingham and District Electric Club.—Friday, October 27th. At the Grand Hotel. At 7 p.m. Annual ladies' night. Whist drive and dance.

Institution of Mechanical Engineers.—Friday, October 27th. At the Institution, Storey's Gate, S.W. At 6 p.m. Adjourned discussion on Prof. A. Rateau's paper on "The Use of the Turbo-compressor for Attaining the Greatest Speeds in Aviation."

Diesel Engine Users' Association.—Friday, October 27th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. Discussion on "The Care and Maintenance of Diesel Engines," to be opened by Mr. G. E. Windeler.

Electrical Power Engineers' Association (Southern Division).—Saturday, October 28th. At the Hotel Cecil, Strand, W.C. At 5.30 p.m. for 6 p.m. Fourth annual dinner.

THE MANGAHAO TRANSFORMERS.

A Ferranti 110,000-volt Installation.

The development of electricity supply in Australasia generally is progressing at a rapid rate, and to cope with the demand large schemes are in hand and others are contemplated. In the North Island of New Zealand water power is being utilised to a considerable extent, the various generating stations being interconnected and the energy distributed by means of e.h.p. transmission lines as shown on the accompanying map (fig. 1). For such schemes larger plant and considerably higher pressures are used than we are accustomed to in this country. In the British Isles the distances over which electrical energy has to be transmitted are comparatively short, and therefore very high pressures are not necessary.

This fact is not always realised, and because we do not manufacture high-pressure plant of large capacity for our own use it is often assumed that we cannot produce it. Those who have had need of such equipment in the past have been too ready to consider that Britain has not the requisite experience to undertake the work.

That such an opinion, however, is erroneous calls for the utmost emphasis, and it is gratifying to be able to record yet another instance that will prove it so.

At the Mangahao hydro-electric generating station (see fig. 1) power is generated at a pressure of 11,000 volts, three-phase, groups of transformers being employed to raise the pressure to 110,000 volts for transmission by means of overhead lines. This is the highest voltage so far employed in Australasia, and the transformers which are being built by Messrs. Ferranti, Ltd., to the order of the New Zealand Government Public Works Department are the first of their size and voltage to be made in Great Britain. It is a matter for gratification that the order was placed in England, and Messrs. Ferranti may well be proud of having secured it, notwithstanding competition, at a price equal to, if not lower than, that quoted in the United States.

The plant that is nearing completion at Hollinwood comprises two three-phase, 50-cycle, 12,000-kVA banks of transformers, *i.e.*, seven 4,000-kVA units, one being a spare; their impedance is 6 per cent., and some idea of their size may be obtained from the fact that each transformer weighs, with its oil, 21½ tons, while the weight of each core is 7 tons, and that of each coil 1¼ tons. No less than 1,760 gallons of oil is needed to fill each tank.

The transformers are of the oil-immersed, forced-cooled, double-wound core type, connected in star on the h.p. side and delta connected on the l.p. side. On the latter side tappings are arranged for 11,000, 10,750 and 10,500 volts; the full output may be obtained from all the tappings. The neutral point is earthed. The accompanying illustrations show one complete 3-phase group (fig. 2) and parts in various stages of manufacture.

Fig. 1.—New Zealand, North Island.

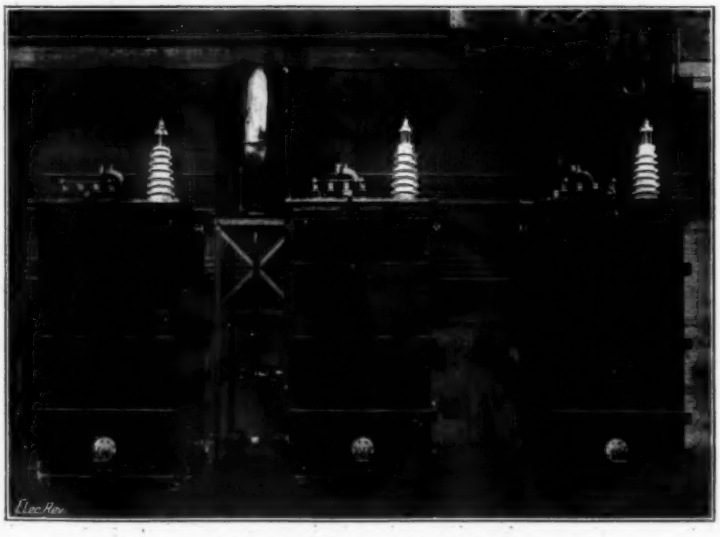


Fig. 2.—A 12,000-kVA Bank of 110,000-V Transformers.

Single-phase units were adopted owing to the difficult roads leading to the site, and the mechanical construction of the transformers is such as to allow of transport on their sides in their tanks. Easy means are provided for lifting the transformers (centre point lift), and due precautions are taken to prevent parts working loose through vibration under working conditions.

The windings are arranged concentrically on the core; the l.p. windings are of the single-layer spiral type, and ample oil ducts for ensuring uniform cooling of the windings are provided, two sides of every turn being in direct contact with moving oil. All the l.p. leads and tappings are brought to ter-

minals outside the transformer, so that the tappings may be easily changed. The h.p. side is wound in sections of disk coils of one turn per layer, thereby reducing the voltage stress between turns to a minimum. Radial

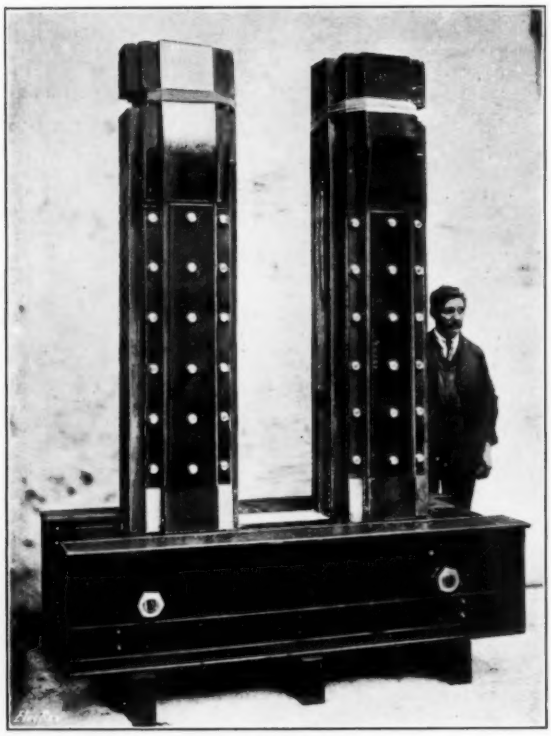


Fig. 3.—A Single-phase 4,000-kVA Transformer Core.

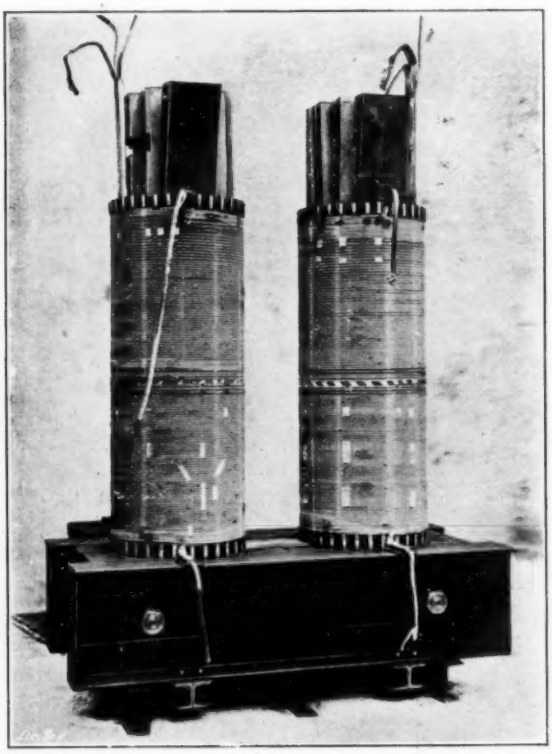


Fig. 4.—Low-pressure Windings on Core.

ducts are arranged between the sections so that every turn is in direct contact with the cooling oil. The windings as a whole are designed to ensure uniform cooling throughout. The oil ducts are so proportioned in relation to one another as to size and disposition that the circulation of cooling oil is maintained constant and uniformly effective. The oil circulation is distributed throughout the whole of the transformer so that local hot spots and dangerous temperature gradients are avoided.

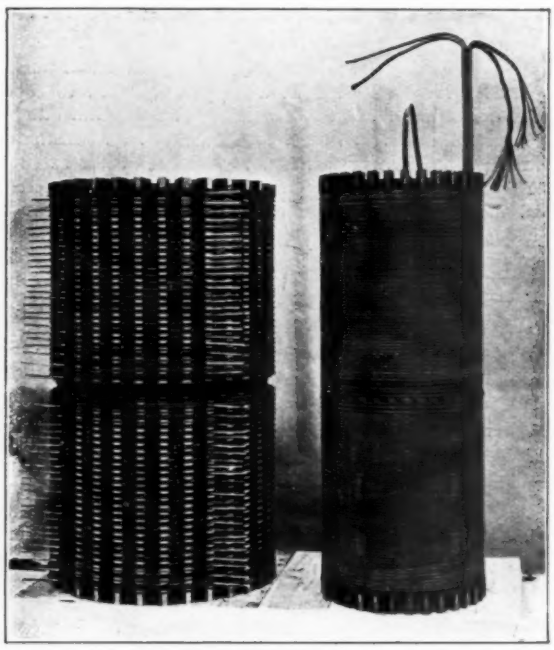


Fig. 5.—Transformer Coils.

The main transformer insulation is designed to avoid all danger of creepage along insulation surfaces and through laminated insulation in the direction of the laminæ. The end turns of both h.p. and l.p. windings are specially insulated to withstand surge voltages and transient disturbances. The coil dimensions and the relative dispositions of the h.p. and l.p. windings are so arranged that the electrostatic and electromagnetic

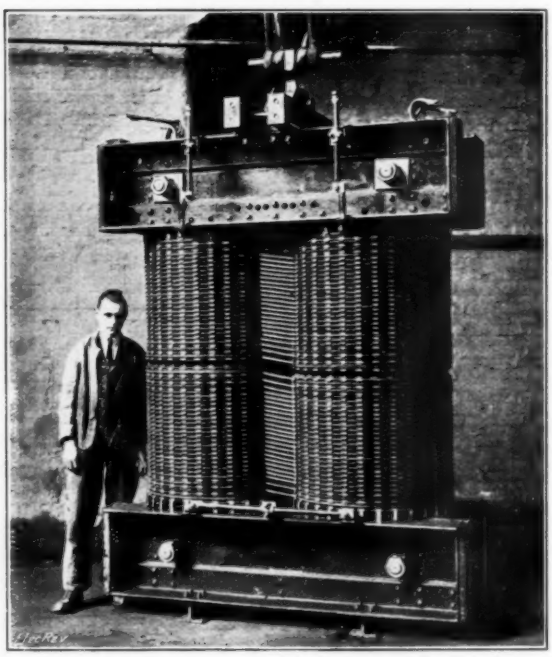


Fig. 6.—Low-pressure Side of Complete Unit.

balances are preserved at all voltages. For this reason also the l.p. tappings are brought out through the middle of the windings so that the overall dimensions are not changed with the voltage ratio.

The dielectric field is so controlled as to render the voltage gradients as uniform as possible and to reduce

to a minimum the electrostatic stress between the high-potential winding and ground and between the coils and

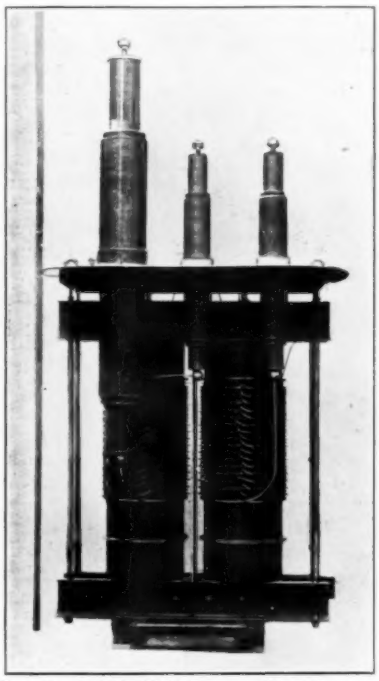


Fig. 7.—A 200,000-V Testing Transformer.

turns of each winding. The windings are adequately braced to withstand mechanical shocks which may occur under working conditions, including those produced under short circuits, while with the circular form of coils used, great mechanical strength is obtained, as under magnetic stress the coils tend to assume a circular form.

A spring clamp device is fitted between the coil sections. This device is arranged so that it takes up effectively any shrinkage which may occur in the coils. The adjustment is automatic, and therefore does not require frequent attention and tightening of bolts.

One set of oil-cooling apparatus, comprising a cooler, a centrifugal oil pump, motor, and controlling gear, is provided for each three-phase group. A conservator tank fitted with a calcium chloride breather and drier is connected to each bank to prevent moisture getting into the oil and reducing its dielectric strength, and also to prevent oxidation of the oil with consequent formation of sludge and harmful acids.

The h.p. terminals are of the oil-filled porcelain type, and as the transformers are designed with graded insulation they cannot be subjected to the usual flash test. The specification calls for the application of 23,000 volts to the low-pressure winding, and this must necessarily be of a frequency of 100 cycles, for which a special 500-kW alternator was used.

In conclusion, we have to thank Dr. Ferranti and his staff for the courteous manner in which we were received on the occasion of our visit to Hollinwood. Much of interest in connection with high-pressure work was seen and learned there, *à propos* of which fig. 7 illustrates a 200,000-volt testing transformer built for the Newcastle-on-Tyne electricity supply undertaking; the top of the tank is 8 ft. above the ground, and the top of the insulator is 13½ ft. above ground level. Several similar transformers have been built, and one for 500,000 volts is about to be put in hand.

EXTENSIONS AT STAFFORD ELECTRICITY WORKS.

The electricity undertaking of the Corporation of Stafford, which was established in 1895 under the guidance of the late Dr. John Hopkinson, originally contained three rope-driven dynamos of 63 kW each; in 1901 the plant was extended and the supply pressure doubled, and the first Highfield booster was installed, Mr. J. S. Highfield having been the first electrical engineer to the Corporation. From 1902 to 1913 the engineer was Mr. R. E. Meade, who now, as Councillor Meade, is Deputy Mayor and chairman of the Electricity Committee; Mr. Meade further extended the plant in 1906 and 1912. His successor, Mr. W. H. Robins, M.I.E.E., the present engineer and manager, experienced a rapid increase in the demand on the outbreak of war, and prepared a scheme of extensions, which was submitted to Mr. S. L. Pearce, city electrical engineer, Manchester, and a 500-kW geared turbo-generator was installed in 1916. The Ministry of Munitions, however, would not sanction the purchase of suitable boilers, and therefore the turbine, which was the mainstay of the station, had to be worked at a reduced efficiency owing to the low boiler pressure.

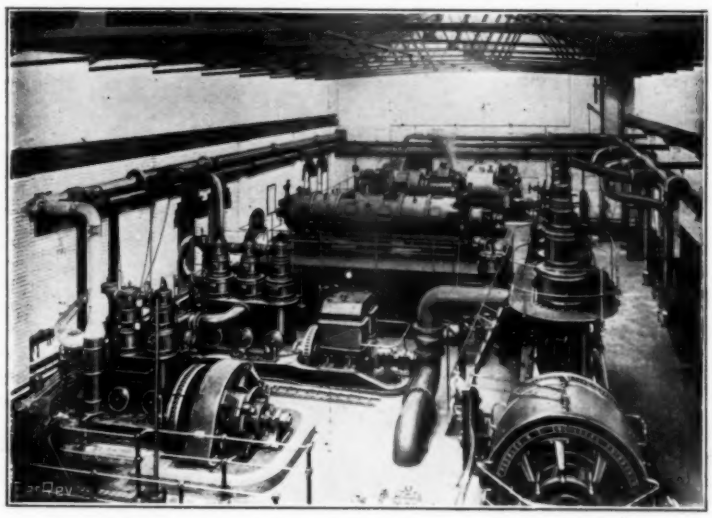


Fig. 1.—Engine-room, Stafford Electricity Works.

In 1918 further extensions were necessary, and on the recommendation of the Ministry, approved by Mr. Pearce, tenders were obtained for two 1,250-kW turbo-alternators and two water-tube boilers, each of 15,000 lb. evaporative capacity, together with a rotary converter to assist the d.c. plant. However, before the consent of the Ministry was obtained the whole of the plant offered had been disposed of elsewhere. The need for new plant was imperative, and was met by the purchase of a 1,000-kW English Electric turbo-alternator, a 1,600-kW Brush-Ljungstrom turbo-alternator, a 500-kW Metropolitan-Vickers rotary converter, and two Stirling boilers each of 15,000 lb. per hour evaporative

capacity. This is the plant which, as recorded in our last issue, was formally inaugurated on October 4th.

The generating set supplied by the English Electric Co., Ltd., comprises a disk-and-drum turbine coup'ed to an alternator built at the Stafford works, having an output of 1,250 kVA at 6,600 volts, 50 cycles per second, and is provided with Worthington condensing plant and a Heenan & Froude air filter.

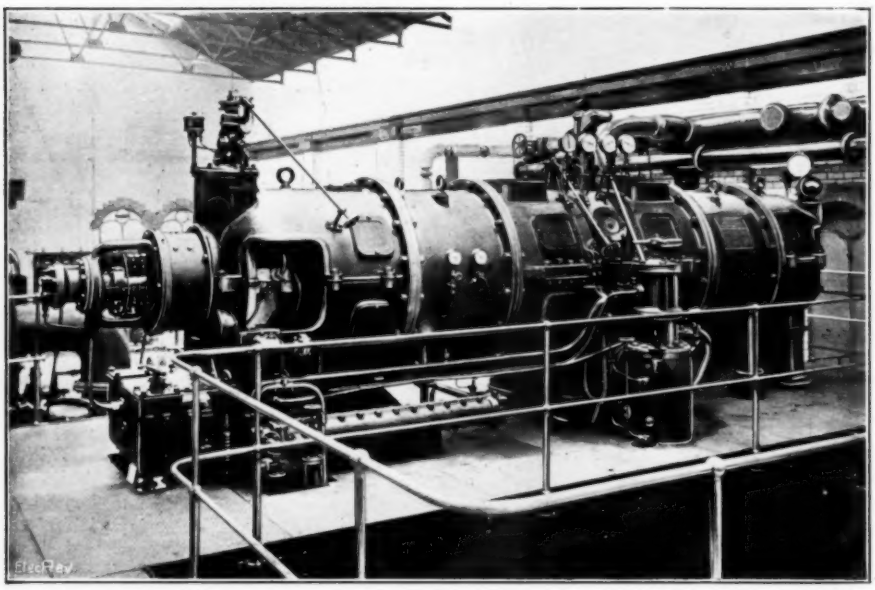


Fig. 2.—Brush-Ljungstrom 1,600-kW Turbo-generator.

The Brush Electrical Engineering Co., Ltd., Loughborough, has supplied one 1,600-kW standard Brush-Ljungstrom set, designed to work at a pressure of 170 lb. per sq. in. at the turbine stop valve, superheated 150 deg. F., and exhausting into a vacuum of 28½ in. of mercury (barometer 30 in.). The turbine is directly coupled to two three-phase alternators having a combined output of 1,600 kW at a power factor of 0.8, equivalent to 2,000 kVA. The exciter is directly coupled to one of the alternators, and the regulation of the set is effected solely by regulation of the exciter field. The combined set runs at 3,000 r.p.m., and is capable of carrying an overload of 25 per cent. for two hours.

The turbo-alternator set is mounted on a Brush surface condenser, according to the standard method adopted for this plant. The whole of the weight of the turbo-alternator is carried by the condenser, resulting in a great saving of foundation work.

The surface condenser has a cooling surface of 3,150 sq. ft., and is capable of dealing with 20,800 lb. of exhaust steam per hour, with circulating water at a temperature of 65 deg. F. The condenser is provided with a three-throw Edwards air pump, driven by a Brush standard d.c. motor through gearing.

The circulating pump was manufactured by Messrs. Stone & Co., and is capable of delivering 2,775 gallons per minute against a total head of 25 ft. when running at 750 r.p.m. The pump is driven by a 30-h.p. standard Brush motor, to which it is directly coupled. The motors are controlled by panels manufactured by Messrs. Brook, Hirst & Co., Ltd.

For filtering the air to the alternators, a Cleworth Wheal wet air filter has been provided, and this is driven by a 1-h.p. motor.

A feature in connection with this turbo plant has been the installation of an Igranic diaphragm type oil-pressure operated apparatus and relay, so arranged that when the oil pressure in the bearings falls below a stated value, the relay operates and trips the circuit breaker on the main switchboard.

Tests taken after the set had been installed on site proved that the steam consumption of the set was well within its guaranteed limit.

The rotary converter, built by the Metropolitan - Vickers Electrical Co., Ltd., is self-synchronising, has a starting motor, and is fitted with oscillating gear. The same company supplied the high - pressure switchgear, and a d.c. feeder switchboard to replace the existing board, which was dangerously overloaded.

The new Stirling boilers are fitted with mechanical stokers manufactured by the Underfeed Stoker Co., Ltd.; these stokers have a common forced-draught plant. A steel chimney 96 ft. high, together with an induced-draught plant, has also been installed, the existing stack being inadequate to deal with the gases from all the boilers.

In 1921, due to the general slump in trade, the committee debated as to the advisability of proceeding with the scheme, and engaged Mr. Arthur Ellis, of Cardiff, to advise on it. Mr. Ellis generally approved the scheme, but hardly considered that the committee had gone quite far enough. He recommended a further expenditure of £45,000, this to provide for a further generator, a rotary converter, having an output of 1,000 kW, and further boiler plant in order to do away entirely with the out-of-date and inefficient plant. These recommendations will be carried out in the near

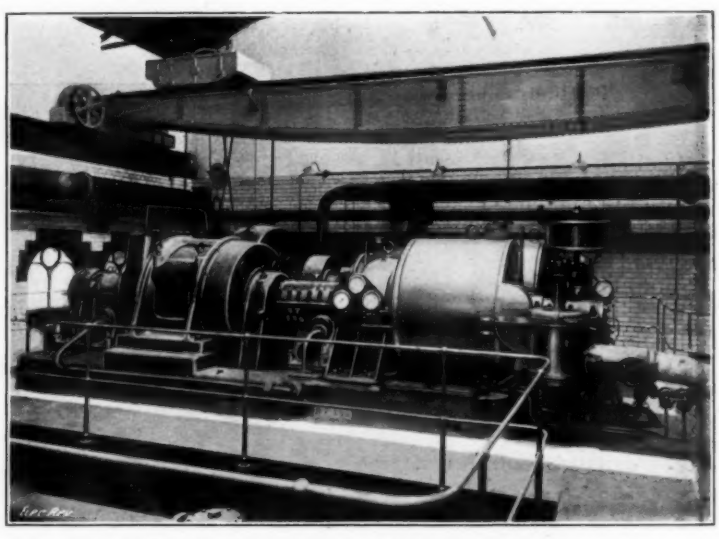


Fig. 3.—English Electric 1,000-kW Turbo-generator.

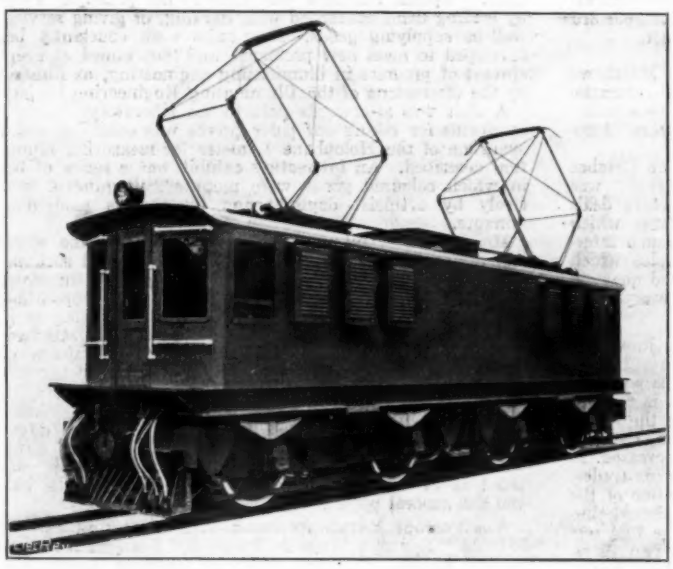
future; the four Lancashire boilers have already been disposed of, and a Stirling boiler, having a capacity of 20,000 lb. evaporation per hour, has been ordered, the foundations for which are now in progress, part of the boiler having already been delivered.

The output of the station is far greater than last year, and the manager hopes to be able to report very nearly 4,000,000 units generated for the year ending March, 1923.

AN ENGLISH ELECTRIC LOCOMOTIVE.

The accompanying illustration shows one of the 48-ton main-line electric locomotives which have been designed, built, and equipped by the English Electric Co., Ltd., for the Arthur's Pass Section of the Midland Railway of New Zealand.

Each of these locomotives will be equipped with four 1,500-V, 170-h.p. direct-current motors of the ventilated type, with controlling gear of the cam-shaft type devised by the English Electric Co.



An "English Electric" Locomotive for New Zealand.

The contract in connection with which these locomotives are being constructed comprises the supply of the generating plant, the transmission line, and the complete equipment for the electrical operation of the section, including the locomotives for both passenger and goods trains. Particulars of the contract were given in our issues of September 17th and November 12th, 1920.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week we need the names of manufacturers or suppliers of:—

The Gibson patent terminals.
The Ozon electric lamp.
Galalith insulation.
The Collins universal travelling iron.
A ceiling rose enclosing a switch operated by a chain.
Also the address of Electric Scaling Hammers, Ltd.

London 'Bus Guide.—The London General Omnibus Co. has issued a re-modelled guide to its services. The new guide is much clearer than its predecessors owing to the strengthening of the colour tones in the map and the re-lettering of the names of districts, &c.

NOTES.

Ilford Super Kinema.—The opening ceremony of the above new theatre was performed on October 14th by Mr. B. S. J. Pitt, chairman of the Urban District Council, who was supported by the Marchioness of Queensbury and Mr. Frederic Wise, M.P. It has been built by Messrs. Sheffield Bros., Ltd., for Super Cinemas (Ilford), Ltd., the architect being Mr. W. E. Trent, F.S.I. At the point of the triangle on which the building has been erected is the main entrance to the theatre. A series of glazed swing doors lead to the foyer and lounge. At the end of the foyer is the grand staircase leading to the café lounge on the first floor, and thence to the balcony of the theatre. From the top of the grand staircase, on both sides, vaulted corridors run round to the balcony entrances, with exits at both the proscenium and operating ends. Over the café lounge and approached by staircases from each end a roof garden is planned to be furnished next year. Excluding the main entrance, there are ten separate exits leading direct to a public thoroughfare, which would enable the building to be emptied in two minutes in an emergency. The exceptional size of the foyer and lounge should obviate the necessity for forming waiting queues outside the theatre. The building is treated externally on rather severe lines. The building is dominated by a copper-covered cupola supported on open columns and flood-lighted by means of 24 lamps, in addition to six flambeaux at the corners. The seating accommodation on the ground floor is 1,800 and in the balcony 700, a total of 2,500.

The internal decoration is in the "New Art" style. The colourings are daring in harmonies and quaint in form. Groups of quaintly-designed lanterns and erratic colourings hang from the ceiling, bays, and wall brackets, and suspended balloon lights and an aerial fountain complete an original electric lighting scheme. Quaint designs also come into the leaded window lights, whilst the draperies are in jazzy colouring. The entire decoration scheme has been carried out by Val Prince Decorations, Ltd., Birmingham.

In the lighting of the theatre some novel points have been introduced. The ceiling lights are an integral part of the design of the ceiling instead of being merely suspended therefrom, and additional light is obtained from the bull's-eye windows in the frieze and from vases round the balcony front. It is all electric, and no white light is used anywhere. The system of heating and ventilation is that known as the "semi-plenum" fresh-air supply with mechanical foul-air exhaust. The plant is electrically driven and capable of dealing with two million cubic feet of air per hour, and will change the atmosphere once every ten minutes in the more important parts of the theatre. The air is drawn from outside at a height of 30 ft. above ground. It is then filtered, washed, and purified, and, in cold weather, warmed by being drawn through a heating battery. It may be added that a complete electrically-driven vacuum-cleaning installation has been fitted throughout the building.

A large three-manual electrically-driven orchestral organ has been installed by Messrs. Henry Speechly & Sons.

Messrs. Harrison Bros., Middlesbrough, carried out the electrical work. Two Kershaw projectors by the Sun-Light Arc Corporation are installed, in addition to an advertising lantern and four spot lights. The theatre light-dimming is operated in conjunction with electric screen curtain lowering gear. Two Electric Construction Co.'s motor generators serve the projectors. "Welco" ironclad gear has been installed, and the 14 motors in the building demand about 150 A at 460 V. The lighting load of 200 A is balanced on the two sides of the 460-V mains, while a Fuller 600-Ah battery serves lights that are distributed over the building so as to provide sufficient illumination in the event of a failure of the supply—an unlikely event since three separate sources of supply have been arranged for. Callender's cable has been used throughout.

The Reinartz Tuner.—The first meeting of the new winter session of the Leeds and District Amateur Wireless Society was held on October 13th, and was devoted to the presidential address of Mr. A. M. Baige. His subject was "The Reinartz Tuner," the recent one-valve American development calculated to cut out interference and allow very fine tuning. Though it had novel features, he thought in its present form it was hardly likely to replace the existing types, even though its price was a little less than the feed-back or regenerative set.

Ore Smelting in Switzerland.—The management of the Lauffen Electro-Chemical Works at Laufenburg states that as a consequence of the present unfavourable economic conditions the experiments which were to have been made with the smelting of Swiss iron ores have been postponed. Technical difficulties are said not to stand in the way of the experiments.

The Engineers' Club, London.—The first annual report of the directors of The Engineers' Club, for the period ending August 31st, 1922, shows a surplus of £431, after making ample provision for maintenance, all possible contingencies, and the amortisation of the leases. Second debentures to the value of £32,975 have been taken up, and £10,000 reserved for an applicant, leaving a balance of £32,025, which it is hoped will be readily subscribed for now that the success of the Club is assured. When the whole of the second debentures have been taken up, they will automatically become first debentures and constitute the sole charge on the property of the Club.

The General Committee reports that Sir Robert A. Hadfield, Bart., F.R.S., has consented to take office as president for the ensuing year, and expresses the gratitude of the members to Mr. E. Manville, M.P., the retiring president, for his pluck and foresight in giving his support to the Club in its initial stages. At the date of opening (September 1st, 1921) the elected members of the Club numbered 2,615; losses through death and resignations during the year amounted to 161, and owing to the severe depression in trade, 493 would-be members had to cancel their applications, leaving a net total of 1,961; new members were elected during the year to the number of 1,224, making the total membership at August 31st, 3,185. The premises have been maintained in the highest state of efficiency, and the annexe has been completely redecorated and refurnished.

Minor alterations to the rules will be submitted for approval at the general meeting, which will be held on November 3rd at 12 noon, at the West End Cinema, Coventry Street.

Lectures.—On Wednesday last Mr. R. Borlase Matthews was to give a lecture on "Auto-countancy, or Semi-automatic Double Entry Book-keeping" (by the aid of an electrically-operated machine) before the Office Machinery Users' Association.

At the Birmingham and District Electric Club on October 14th a lecture upon "Alternating Current Apparatus" was given by Mr. F. R. Unwin, A.M.I.E.E. The lecture dealt in particular and in some detail with the problems which confronted designers of a.c. apparatus, and gave much interesting and valuable information as to the principles which underlay the solution of these problems. The vexed question of power factor and the use of synchronous motors was treated at some length.

Swedish Hydro-Electric Works.—A report has just been presented to the Swedish Parliament by the State Hydro-Electric Administration in relation to the power sale possibilities in the new financial year, and the conclusion is reached that no new generating stations are necessary. At the outset the report points out, in explanation of this decision, that the consumption of energy last year considerably decreased in certain industries, particularly the iron and engineering trades, owing to the great depression. As to the electrification of the railways, the report submits that the work on the Stockholm-Gothenburg railway cannot be completed before the first section of the Lilla Edet power station is finished in two years, when this station, in conjunction with the Trollhattan works, would be able to provide the power required by the railways. It is uncertain whether any arrangements will be made for the delivery of power to the South, as agreements have hitherto not been made either with the South Swedish Power Co. or with possible Danish consumers. It would be possible to supply the power which would be sent along the proposed main transmission line to the South from the power works in the Gota River at Trollhattan and Lilla Edet, particularly as the profile regulating works between Trollhattan and Vargon have been put in hand. Under these circumstances the administration is unable to recommend the establishment of any new power stations either in the South or in Central Sweden, or in Norrland. A grant of 2,600,000 kronen is asked for in 1923-24 for the completion of the first section of the Lilla Edet station, which is to be finished in 1924 at a total computed expenditure of 13,830,000 kr.

A Large Colliery Winder.—On the occasion of the recent visit of the South Staffordshire and Warwickshire Institution of Mining Engineers to the Hilton Collieries of the Holly Bank Coal Co., Ltd., the Metropolitan-Vickers Electrical Co., Ltd., issued a souvenir booklet containing details of the 1,350-h.p. geared electric winder. This consists of a synchronous induction motor running at a speed of 300 r.p.m. driving, through reduction gears, a drum at 35-45 r.p.m. The shaft depth is 1,800 ft.; the net weight of coal per wind is 13,440 lb.; and the number of winds per hour 50; giving an output per hour of 300 tons. The drum is of the cylindro-conical type, the diameter falling from 21 ft. 6 in. to 11 ft. The energy consumption per wind is estimated at 16.4 kWh. The controlling apparatus is of the weir type, with fixed electrodes, and adjustable pumping arrangement for the electrolyte, whereby the rate of acceleration of the winder is not entirely dependent upon the driver. The "M.-V." patent overspeed and slow-brake device has been fitted in order to give additional protection during the full-speed running and retardation periods. The switchgear controlling the winder is mounted in sheet-steel cubicles, and provision is made for a duplicate supply at medium pressure for the auxiliaries of the winder. A slip-reducing device adds considerably to the efficiency of the equipment.

Scientific Illumination.—A representative gathering assembled at the new showrooms and laboratories of Messrs. Holophane, Ltd., Westminster, on October 10th, in response to an invitation by the company. After the visitors had been received by Mr. H. H. Thompson, the managing director, an address was given by Capt. E. Stroud, who recalled that the arrival of the electric incandescent lamp had been largely responsible for the development of more scientific methods of shading. When the metal-filament lamp, and later the gasfilled lamp, with its still greater brilliancy, came on the scene, the use of globes and reflectors, in order to avoid glare, became necessary. At the same time, the value of a properly-designed reflector in directing light where it was needed, came to be more fully appreciated. Early pioneering work on prismatic glassware was done in this country by Mr. A. P. Trotter, and afterwards Prof. Blondel and Mr. Psaradouki, in Paris, developed the idea more fully. The Holophane Co. based its efforts on the collective experience of nearly 30 years, and had developed a great variety of lighting units for special purposes, one great advance being the introduction of reflectors with an inner smooth surface and prisms on the outside, operating by total internal reflection. Capt. Stroud's remarks were illustrated by numerous lantern slides and by exhibits of glassware, some of historical interest, others of the latest design. Among the latter special interest attaches to a new form of flood-lighting unit, and to the unit equipped with Chance daylight glass to yield "artificial daylight." Special reference was made to the principle, adopted by leading firms concerned with lighting, of giving service as well as supplying goods. New units were constantly being developed to meet new problems, and they aimed at keeping abreast of progress in illuminating engineering, as illustrated by the discussions of the Illuminating Engineering Society.

A visit was afterwards paid to the laboratory, where the apparatus for taking out polar curves was exhibited and the operation of the Holophane Lumeter for measuring illumination described. An interesting exhibit was a series of boxes in which coloured goods were mounted, illuminated respectively by artificial daylight and by various modern illuminants.

Mr. L. Gaster returned thanks on behalf of the visitors, and remarked that lighting was of interest to all sections of the community. Illuminating engineering had, therefore, a special interest for technical journalists. The appointment, in 1913, of the Home Office Committee on Lighting in Factories and Workshops illustrated the importance attached to the subject. One point which he wished to emphasise was the need for co-operation between the lamp-maker and the manufacturers of globes and reflectors, as the distribution of light might be radically altered if a lamp of an entirely different type and size from that for which a reflector was intended was used. He hoped that in future each scientific advance would be brought to the notice of the technical Press, which acted as an important educational link between the expert and the general public.

Non-Ferrous Metals Research.—An interesting pamphlet, entitled "Research Work in Progress," has just been issued by the British Non-Ferrous Metals Research Association of Birmingham. The investigations in hand cover many problems of the copper, brass, aluminium, nickel, and lead industries, as well as subjects of importance to all users of such metals. The support given to the Association by the leading firms seems to be most encouraging, but the field covered is very wide, and many of the researches, such as those on the improvement of brass, on metal polishing, and on soldering, should attract the attention and support of many other sections of industry. The user is apt at first sight to overlook the fact that he is even more interested in the improvement of quality of his raw material than the manufacturer of the metal. In the case of failure, it is the user who always bears the greater loss, since he sacrifices all the time and workmanship which has been expended on the article being manufactured. The Bureau of Information of the Association also seems to be doing excellent service in distributing to members reports of the results of the experimental researches and acting as an intelligence service collecting and distributing information likely to be of service to the industry from the far corners of the world. Finally, some indication is given of the further work which the Council hopes to take up when additional financial support is forthcoming, which includes matters of moment to the electrical industries, to die casters, and to the tinplate trade.

Birmingham Electrical Golfing Society.—The autumn meeting was held on Walmley links, in delightful weather. The Dr. Railing Cup was up for competition, this being won by Mr. W. L. Topple, with a very steady card of 72. The second and third prizes were taken by Mr. J. H. Berry, and Mr. E. L. Ball, the sealed nine holes being won by Mr. W. A. Millinger. In 1923 there will be a fourth cup up for competition, presented by Mr. Topple.

A Well-prized Electric Vehicle.—At the Liverpool parade of commercial motor vehicles (organised by the C.M.U.A.), held a few days ago, the first prize in the electric vehicle class was won for the third consecutive year by a five-ton Electromobile vehicle belonging to Messrs. Tate & Lyle, the well-known firm of sugar refiners. This machine is used for the transport of produce between Messrs. Tate & Lyle's works and the docks

Electricity Districts.—North-East Midlands Inquiry.—At the Town Hall, Sheffield, on October 17th, Sir John Snell (chairman), Sir H. Haward (vice-chairman), and Messrs. H. Booth and A. Page, accompanied by Mr. E. W. Hudson (solicitor) and Mr. D. S. Cumberlege, sat as an Electricity Commission to inquire into the scheme submitted by the Sheffield Corporation for the constitution of a Joint Electricity Authority for the above-named area. The scheme, which was outlined in our issue of July 15th, 1921, is the only one that has been put forward with respect to the district, and it is supported by the Rotherham Corporation. Further details will be published in our next issue.

North Wales and Chester.—The Electricity Commissioners intend to hold a second local inquiry at the Town Hall, Llandudno, on November 14th, with reference to the scheme published by them for the improvement of the existing organisation for the supply of electricity in the North Wales and Chester District (see Elec. Rev., April 29th, 1921). A draft order constituting the district and establishing a Joint Electricity Authority therefor has been issued, which we hope to review next week.

Procedure at Local Inquiries.—In December, 1920, the Commissioners issued a memorandum dealing mainly with the procedure at local inquiries held under Section 5, Sub-Sections (1) and (2) of the Act of 1919. Under the procedure followed at first inquiries, consideration and evidence were mainly directed to questions of principle or preamble involved, and to the technical scheme or schemes submitted to the Commissioners. Matters of detail (in some cases important details) and what may be termed "clause points" were generally excluded from consideration or expressly reserved for the second inquiry. The approval of the Commissioners to the scheme published by them for the purposes of the second inquiry must, therefore, be regarded as an approval subject to consideration in the light of the further representations and evidence (if any) that may be forthcoming at that inquiry.

With regard to the form of the various clauses in the published scheme, the Commissioners, in dealing with items likely to be common to all (or the majority of) schemes for the reorganisation of supply, have endeavoured, we are officially informed, to frame "common form" clauses capable of adaptation (where necessary) to the special circumstances of any particular district. As the approved scheme published for the purposes of the second inquiry is based on and gives effect to decisions arrived at by the Commission as a result of the first inquiry, it is unnecessary that previous evidence should be repeated at the second inquiry. On the other hand, the Commissioners will be prepared to hear any general statement which any interested party may desire to make by way of objection on matters of substance or principle dealt with in the decisions of the Commissioners. It will not be necessary for evidence to be given in support of any such objection unless so desired by the party concerned, and then only for the purpose of substantiating matters on which evidence was not tendered at the first inquiry.

Any objections on matters of principle having been dealt with in the manner above indicated, the clauses of the approved scheme and of the draft Order to give effect thereto will then be taken *seriatim* and representations thereon heard. In cases where written representations on particular clauses have been made to the Commissioners prior to the second inquiry, they will announce, before such clauses are taken, whether they are prepared to accept the proposed amendments. The Commissioners suggest that unless important new issues are proposed to be raised, it will ordinarily be unnecessary for parties to be represented by counsel at the second inquiry.

Educational.—London.—The first of a series of lectures by Mr. Theodore Stevens, M.Inst.C.E., upon the utilisation of water power was delivered at University College on Monday last. This dealt with "Fundamental Principles and Practice." Subsequent lectures will deal with: "Measurement and Survey"; "Best Utilisation of Available Power"; "Storage of Water *v.* Auxiliary Power"; "Dams, Waterways, Tunnels, and Pressure Pipes"; "Equipment of Low-head Plant"; "Equipment of Medium-head Plant"; "Equipment of High-head Plant"; "Niagara Plant, 1851-1922"; and "Future Water Power Developments." The lectures will be illustrated by lantern slides. The course is open, without fee, to engineering students of University College who have paid a third-year composition fee. To registered students in the faculty of engineering at other colleges the charge is £1 11s. 6d.; to others, £3 3s. Application for tickets of admission should be made to Mr. Walter W. Seton, M.A., secretary, University College, Gower Street, W.C.1.

University College.—A Goldsmid Engineering Entrance Scholarship at University College, London, value £30 a year, tenable for three years, has been awarded to Mr. T. A. L. Paton, of Cheltenham College.

West Bromwich.—Recognising the growing importance and popularity of wireless, the West Bromwich Education Committee has included in its evening schools curriculum for the coming winter a series of 25 lectures on the fundamental principles of wireless telegraphy and telephony. A large number of students have enrolled, and the class will probably form the nucleus of a wireless club for the town at the end of the session.

Liquid Fuel Congress.—The International Liquid Fuel Congress opened on October 10th at the premises of the International Exhibition, Paris. In the afternoon members attending the Congress visited the Liquid Fuel Exhibition.—*The Times.*

Appointments Vacant.—General manager, director of programmes, chief engineer, and secretary, for the British Broadcasting Co. (in formation); clerk of works, for the Conway Corporation electricity department; cost clerk (£256) and clerk to assistant secretary (£215), for the Edinburgh Corporation electricity department; jointer (90s. 1d.), for the Wimbledon Borough Council electricity works; engineer to take charge of design (£300), for the Admiralty Mining School, Portsmouth; lecturer in electrical engineering (£300), for the Armstrong College; power station chemist (400 taels per month, tael= 3s.), for the Shanghai Municipal Council electricity department. (See our advertisement pages to-day.)

Legal.—British Thomson-Houston Co., Ltd., *v.* The Emergo Economic Lamp Co., Ltd.—In the Chancery Division, on Tuesday, this case came before Mr. Justice Russell in the form of a motion for judgment, there being no defence. Mr. Whitehead, for the plaintiff company, said it had been decided by both sides to take a judgment by consent. He had agreed with Mr. Courtenay Terrell (for the defendants) as to the form of the order, which was based upon agreed minutes.—His Lordship: Very well.

INSTITUTION NOTES.

Institution of Electrical Engineers.—The opening meeting of the 1922-23 session of the Institution will take place on November 2nd, when Mr. Frank Gill will deliver his inaugural address as president. This will be followed by an ordinary meeting on November 16th, when a paper by the late Dr. G. Kapp on "Phase Advancing" will be read by Prof. Miles Walker.

Wireless Section.—The Wireless Section will commence its meetings on November 8th, with a paper by Messrs. R. L. Smith-Rose and R. H. Barfield on "The Effect of Local Conditions on Radio Direction-finding Installations."

Annual Dinner.—The annual dinner of the Institution will be held on Tuesday, February 6th, 1923, at the Hotel Cecil.

North-Eastern Centre. *Students' Section.*—The first general meeting of the session was held at Armstrong College, Newcastle-on-Tyne, on October 13th, when the chairman, Mr. W. N. Kilner, delivered his inaugural address on "Homopolar Generators."

Chief Technical Assistants' Association.—The subject for discussion at the next meeting of the Association (November 2nd) will be "Consumers' Problems," instead of the subject previously announced. The discussion will be opened by Mr. E. R. Ingram; all meetings take place at the Engineers' Club.

Wireless Society of London.—The Society, which has some 120 suburban and provincial affiliated clubs, announces a new class of membership that will be open to all who hold broadcast receiving licences. Designated associates, they will be able to attain associate membership and full membership when qualified to do so. They will enjoy special elementary lectures and will be welcome to attend the ordinary monthly meetings of the Society. They will be represented on the Council of the Society so soon as their numbers justify it. The Society is to change its name shortly to "The Radio Society of Great Britain."

Faraday House Dinner.—The 14th annual dinner of the Faraday House Old Students' Association will be held at the Hotel Cecil on November 17th, when the president, Mr. P. V. Hunter, C.B.E., M.I.E.E., will take the chair. Members are reminded that they may introduce guests, who need not be Faradians, and the dinner will be followed by a musical programme.

Chelmsford Engineering Society.—Capt. H. Riall Sankey, C.B., C.B.E., &c., delivered his presidential address at a meeting of the Society on October 5th. This took the form of the relation of personal reminiscences which went so far back as 1869. Capt. Sankey's connection with the firm of Willans & Robinson and the growth of that concern occupied a large part of the address.

Association of Mining Electrical Engineers.—On October 7th Mr. G. Henderson, A.M.I.E.E., delivered his presidential address on "Insulation" at the Heriot-Watt College, Edinburgh. Afterwards Mr. R. Rogerson, M.I.Min.E., read a paper on the "Stabilisation of the Mining Industry."

Edinburgh Electrical Society.—At the meeting held on October 13th, at the Philosophical Institute, Mr. G. P. Ewan lectured on "The Walkerburn Hydro-Electric Works." The paper was illustrated with lantern slides. The author stated

the peculiar conditions which led to the adoption of the unique method of storing energy at the Walkerburn Tweed Mills, and indicated that the experience gained in erection and working would be invaluable in dealing with future water plants. With regard to the meeting on October 27th, it was announced that Mr. Buist's paper would not be available, but that Mr. J. G. Burchell would lecture on "Country House Plants."

Manchester Association of Engineers.—On Saturday last the members of the Association visited the new electric power station of the Manchester Corporation at Barton, and were shown over the undertaking, so far as it has been completed, by the departmental staff. The station occupies 14¼ acres of Trafford Park, and it will probably be completed by December, 1923. The officials hope to make some use of the station by the spring of next year if operations are then sufficiently advanced

On October 13th Mr. Daniel Adamson, M.I.Mech.E., delivered his presidential address, and medals were presented to members for papers read during the last session.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Mr. B. D. F. Docker has joined the board of the Anglo-Argentine Tramways Co., Ltd., in place of the late Mr. W. F. Hamilton.

Mr. J. T. G. Murison informs us that he has relinquished his connection with the Electrical Mineral Products.

Councillor W. J. Talbot, chairman of the Electric Supply Committee of the Walsall Town Council since 1920, is not seeking re-election in November.

It is announced that Mr. Sturdee, of Coventry, is to succeed Mr. W. Parker as works manager of the English Electric Co., Ltd., at Stafford.

Mr. J. W. Townley, chief assistant electrical engineer to the Sunderland Corporation Electricity Department, has been appointed deputy city electrical engineer to the Bradford Corporation (see our last issue) at a salary of £800, rising in two years to £1,000. Mr. Townley is a native of Paisley, and has held appointments at Paisley, Manchester, Newcastle-under-Lyne, Sunderland, and Barnsley, where he was acting electrical engineer to the Corporation, before returning to Sunderland as chief assistant in 1919.

Mr. R. D. Spurr, of Bradford, has been appointed to succeed Mr. Townley as chief assistant at Sunderland at a salary of £608 per annum.

To fill the vacancies on the Special Committee on London Electric Supply caused by the resignations of Mr. W. O. Nicholson and Mr. E. Sanger, J.P., the Council is recommended to appoint Mr. J. Perring and Mr. Marshall J. Pike.

Mr. J. C. Fletcher having relinquished his position with the Metallic Electrical Engineering Co., has now taken up the position of representative for Price's Electrical Supplies, Ltd., of Birmingham, for the Midland counties.

A marriage has been arranged, and will take place early in December, between Mr. Ernest Goslin, J.P., M.I.E.E., and Miss Catherine Glen Reid (Daisy), daughter of the late Mr. Peter Reid, consulting engineer, Glasgow. Mr. Goslin is the general manager of the Clyde Valley Electrical Power Co., and was formerly the chief electrical engineer of the Glasgow Corporation Tramways Department.

Leeds University has conferred the honorary degree of Doctor of Science on Sir Dugald Clerk and Sir Richard A. Gregory, and that of LL.D. on Mr. Henry McLaren.

The Institution of Mining and Metallurgy has awarded the Gold Medal of the Institution to Sir Alfred Keogh, C.H., Hon.M.Inst.M.M., on his retirement from the Rectorship of the Imperial College of Science and Technology, in recognition of his great services in the advancement of technological education. The Institution of Mining Engineers has awarded the Medal of the Institution to Sir George Beilby, LL.D., F.R.S., in recognition of his valuable contributions to science, with special reference to his researches on fuel.

Mr. Francis G. C. Baldwin, whose portrait herewith appears, is the chairman of the N.E. Centre of the Institution of Electrical Engineers, and he is to deliver his inaugural address at Newcastle-on-Tyne on Monday next. He was born in 1878, and received his training in general science and engineering at Sheffield Technical School (which subsequently became the Technological Department, Sheffield University) in 1893-1895. He continued at the same institution for his training in electrical science and engineering. After being for a short time with Messrs. Thos. Nash & Sons, Sheffield Testing Works, in 1895, he entered, at the beginning of 1896, the service of the National Telephone Co. as draughtsman. In 1899 he was appointed engineer for that company at Sheffield, and in that capacity completed the metallic circuiting of the subscribers' lines in the area; planned and superintended large extensions of the underground system in Sheffield and vicinity; and planned and superintended the earlier part of a scheme of decentralisation for Sheffield, involving the opening of additional exchanges for relief of the central exchange. In 1906 he was appointed district engineer to the Telephone Co. for Birmingham, a district having at that time 26 exchanges, approximately 14,000

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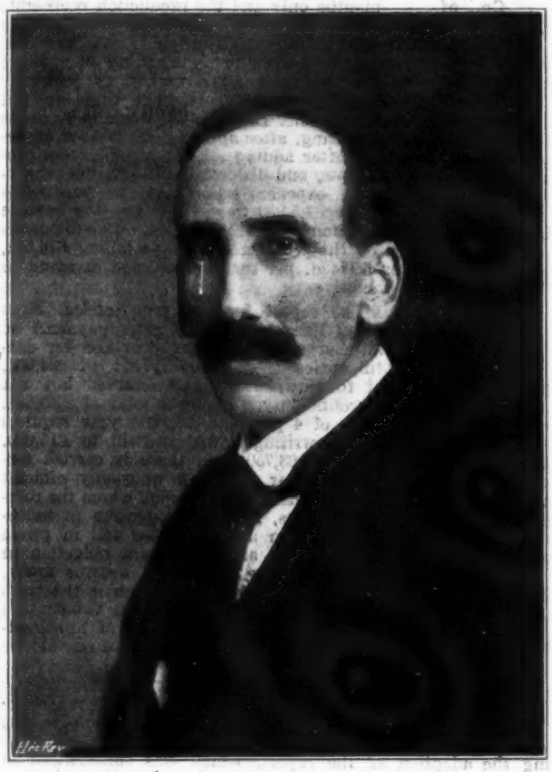
Mr. F. G. C. Baldwin,
Chairman of the N.E. Centre of the I.E.E.

subscribers' stations, and a total wire mileage of 52,000, of which nearly 49,000 miles was underground. He completed the work of decentralisation which had been begun, and planned schemes for, and superintended the work of installation of extensive underground works. He also superintended the execution of the first comprehensive scheme of line loading (with Pupin coils) carried out in this country, which was associated with the junction line system of the Birmingham district, and he reorganised the existing underground work in Birmingham and prepared schemes for conversion from magneto to common battery working on a large scale. In September, 1909, Mr. Baldwin was appointed assistant Metropolitan engineer, and when the task of preparing an inventory of the National Telephone Co.'s plant was commenced in 1910, he assumed charge as acting Metropolitan engineer of the whole of the line plant in the Metropolitan area under the superintendence of Mr. C. B. Clay. Shortly after the acquisition by the State of the National Co.'s system in January, 1912, he assumed charge as sectional engineer of the City external section of the London Post Office engineering district, under the superintendence of Mr. Alex. Moir. In December, 1913, he was appointed assistant superintending engineer of the Northern District of the Post Office Engineering Department, and still remains in that capacity. In 1909 he read a paper on "Some Considerations in the Manipulation of Telephone Dry Core Cables" before the Birmingham Local Section of the Institution of Electrical Engineers, and in 1918, before the I.E.E., one on "Telephone Exchange Transfers and their Organisations"; for the latter the Fahie premium was awarded. For several years Mr. Baldwin officiated as lecturer and demonstrator at evening classes in electrical engineering at Sheffield Technical School. During the past two years he has been devoting his spare time, assisted by numerous friends, to the compilation of a "History of the Telephone in the United Kingdom," which will be published shortly.

Mr. A. S. Barnard, who has been elected chairman of the North-Western Centre of the Institution of Electrical Engineers, has had a long and varied experience in the electrical industry. After serving an apprenticeship with Messrs. Sydney E. Walker & Olliver, Cardiff, he left the firm to take up a partnership with Messrs. Wynne & Barnett, Newcastle-on-Tyne, whose business was the installation of electric lighting and power systems. Subsequently he went to the Corlett Electrical Engineering Co., a firm for which he

superintended many important undertakings. Mr. Barnard's connection with municipal work commenced in 1893, when he was appointed borough electrical engineer of Lancaster. He carried out the erection of the works and superintended the system for two years, after which he moved to a similar position at Hull. There he effected a number of improvements and extensions, the Sculcoates Lane station being erected during his term of office. To Mr. Barnard the electrification



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Mr. A. S. Barnard,
Chairman, North-Western Centre, Institution of Electrical Engineers.

of the Corporation tramways was due. After eight years at Hull Mr. Barnard was for four years consulting electrical engineer to the Government of Ceylon and the Colombo municipality. He then returned home and secured another municipal appointment—that of borough electrical engineer of Walsall. He remained there for about seven years and left, in 1914, to take up a position with the Chloride Electrical Storage Co., Ltd., with which firm he still remains.

Obituary.—Mr. J. Clucas.—The death is announced of Mr. John Clucas, for many years manager of Gellings Foundry, Ltd., electrical and general engineers, of 41, Victoria Street, Douglas, Isle of Man. He had been associated with the concern for upwards of 30 years.

Mr. J. F. Fullerton.—On October 7th, at Paisley Infirmary, Mr. John Forrister Fullerton succumbed to the injuries he received while driving a motor-cycle on the Inchinnan Road on the previous night. For the past eight years he had been employed as a salesman in the Scottish office of Simplex Conduits, Ltd., Glasgow.

Mr. Robert Wood.—We regret to record the death of Mr. Robert Wood, after a brief illness, on October 6th, whereby Messrs. Callender's Cable & Construction Co., Ltd., lost one of their oldest and most valued officials. Mr. Wood, who recently attained his 73rd birthday, went to the Anchor Cable Works 14 years ago as superintendent and chief of the engineering department, a position for which his inventive genius and practical knowledge of cable machinery eminently fitted him. He had previously held appointments with Messrs. W. T. Glover, Ltd., Manchester, and the St. Helens Cable and Rubber Co., Ltd., Warrington. The extensive additions and improvements at the Leigh works during the last 14 years made heavy claims on the chief engineer, but at all times the late Mr. Wood gave of his best, and he was never happier than when devising mechanical schemes for the benefit of the concern in which he was so deeply interested. At the funeral the firm was represented by Mr. J. Bowyer, J.P. (works manager), Mr. Arthur Crooke, and Mr. Wm. Hurst (foreman of the engineering department). Wreaths were sent by the directors and management of Callender's Cable & Construction Co., Ltd., London and Leigh; the members of the Anchor Works staff; employés in the braiding and flexible section; and from the engineers' department.

NEW COMPANIES REGISTERED.

Wireless Installations, Ltd. (184,847).—Private company. Registered October 6th. Capital, £100 in £1 shares. To carry on the business of sellers, manufacturers, assemblers, and installers of wireless receiving sets, &c. The first directors are:—H. C. Phillips, 12, Grosvenor Road, Westcliff, Essex, accountant; Mrs. Beatrice A. Phillips, 12, Grosvenor Road, Westcliff, Essex. Qualification, five shares.

Portmadoc Electrical and Wireless Supplies Co., Ltd. (184,837).—Private company. Registered October 6th. Capital, £500 in £1 shares. To carry on the business indicated by the title. The permanent directors are H. E. Jones, "Royal Sportsman" Hotel, Portmadoc; E. D. Jones, "Royal Sportsman" Hotel, Portmadoc; G. O. Brown, "The Ship" Inn, 14, Lombard Street, Portmadoc. Qualification, £150. Remuneration, £60 per annum, divided between them. Secretary: E. D. Jones. Registered office: New Street, Portmadoc.

Anode Wireless and Scientific Instruments, Ltd. (184,820).—Registered October 6th. Capital, £30,000 in £1 shares. To acquire the goodwill of the business of scientific instrument makers, &c., carried on by Anode, Ltd., and to carry on the business of electricians, manufacturers of generators, suppliers and distributors of electrical energy for lighting, heating, telegraphy, telephony, or any other purpose, telegraphists, telephonists, &c. The subscribers (each with one share) are:—W. E. Peck, 27, Birchington Road, Kilburn, N.W.6, electrical engineer; A. H. Lunniss, 74, Minford Gardens, West Kensington, W.14, scientific instrument maker; J. H. Reyner, 69, Station Road, E.4, electrical engineer; C. L. Grey, 113, Selborne Road, Palmers Green, N.13, advertising agent; G. D. Brewster, 3, King's Bench Walk, Temple, E.C., solicitor; J. H. Brewster, 33, St. Germains Road, Forest Hill, S.E.26, commission agent; C. G. Cherry, 101, Hibbert Road, E.10, solicitor's clerk. Minimum cash subscriptions, £7. The first directors are: Pherozshaw Ruttinjee Minvalla, W. E. Peek, A. H. Lunniss, C. L. Grey and J. H. Reyner. Qualification: £500. Remuneration: £150 each per annum (chairman, £200) and a percentage of the profits. Registered office: 265, Strand, W.C.

Power Securities Corporation, Ltd. (184,817).—Registered with a nominal capital of £2,000,000 in £1 shares (1,000,000 7 per cent. cumulative preference and 1,000,000 ordinary). The objects are: To adopt an agreement with George Balfour, M.P., Andrew H. Beatty, William Shearer and Hugh L. Williams, and to carry on the business of a financial and investment company in all its branches with the object (amongst others) of assisting in the development of engineering and electrical industries; also the business of financiers, bankers, capitalists, underwriters, dealers in land, businesses, concessions, mines and stock, manufacturers, merchants, traders, importers, exporters, shipping agents or ship owners, concessionnaires and contractors for public and other works, &c. Purchase consideration: £220,000. G. Balfour, M.P., A. H. Beatty and W. Shearer are the holders respectively of 22,050, 12,500, and 9,200 fully paid shares in Balfour, Beatty & Co., Ltd., and receive as vendors to the company of such shares, £97,020, £55,000 and £40,480 respectively. H. L. Williams is to receive £27,500. The minimum subscription upon which the directors may proceed to allotment is 7 shares. The first directors are: Sir James Kemnal, K.B., Oriel House, Farringdon Street, E.C.4 (managing director, Babcock & Wilcox, Ltd.); H. C. Levis, Crown House, Aldwych, W.C.4 (chairman and managing director, British Thomson-Houston Co., Ltd.); J. H. Brunel Noble, 8, Great George Street, Westminster (vice-chairman, Sir W. G. Armstrong, Whitworth & Co., Ltd.); G. Balfour, M.P., 66, Queen Street, E.C. (chairman, Balfour, Beatty & Co., Ltd.); A. H. Beatty, 66, Queen Street, E.C. (managing director, Balfour, Beatty & Co., Ltd.); W. Shearer, 66, Queen Street, E.C. (managing director, Balfour, Beatty & Co., Ltd.). Qualification: 1,000 shares. Remuneration as fixed by the company. Solicitors: Roney & Co., 42, New Broad Street, E.C. The registered office is at 66, Queen Street, E.C.

Bartrum Roylance & Co., Ltd. (184,762).—Private company. Registered October 4th. Capital, £5,000 in £1 shares. To take over the business of an electrical engineer and contractor carried on by D. H. Bartrum at Victoria Buildings, Manchester, as "Bartrum Roylance & Co." The first directors are: D. H. Bartrum, 61, Cyprus Road, Southport (permanent governing director subject to holding £1,000 shares or stock); A. B. Waldron, 17, Langdale Avenue, Levenshulme. Qualification: £500. Remuneration as fixed by the company. Secretary: D. H. Bartrum. Registered office: 46, Victoria Buildings, Manchester.

J. Jones & Co. (Nottingham), Ltd. (184,876).—Private company. Registered October 9th. Capital, £3,500 in £1 shares. To take over the business of an electrical engineer, colliery and mill furnisher, iron founder, and manufacturer of and dealer in machinery, carried on by J. Jones, at Canal Street, Nottingham, as "J. Jones & Co." The subscribers (each with one share) are: J. Jones, 97, Wilford Crescent, Nottingham, electrical engineer; C. Jones, 97, Wilford Crescent, Nottingham, electrical engineer. The subscribers are to appoint the first directors. Qualification: £250. Remuneration: £25 per annum. Solicitor: J. A. Simpson, Parade Chambers, South Parade, Nottingham.

Henrion Carbons, Ltd. (184,964).—Private company. Registered October 12th. Capital, £5,000 in £10 shares. To carry on the business of manufacturers, importers and exporters of and dealers in carbon and bronze brushes, arc-lamp carbons, and all electrical carbon manufactured articles. The subscribers are: R. A. Serena, 18, Davies Street, W., director, 10 shares; J. Faggle, 34, Victoria Street, S.W.1, secretary, one share. The first directors are: L. Levi (chairman), R. A. Serena (managing director), R. Hecker, P. Gravier, and E. Chedeville. Qualification: £100. Remuneration as fixed by the company. Registered office: 34, Victoria Street, Westminster, S.W.

H. Stanley Prince, Ltd. (184,874).—Private company. Registered October 9th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of and dealers in electrical machinery, mechanical and electrical engineers, &c. The subscribers (each with one share) are: H. S. Prince, St. Davids, Montague Avenue, Brockley, S.E.4, wireless manufacturer; A. F. L. Crawford, Dallas House, Dallas Road, Hendon, N.W.4, estate agent. The first directors are not named. Registered office: 59, Chancery Lane, W.C.

Taylor's Engineering Co., Ltd. (184,886).—Private company. Registered October 9th. Capital, £2,000 in £1 shares. To acquire the business of hydraulic and electrical and general engineers carried on by J. H. Taylor, F. Taylor and H. Taylor at 56, Canal Street, Manchester, as "Taylor and Co." The first directors are: J. H. Taylor (managing director), 21, Hythe Road, Cheadle Heath; H. Taylor, 78, Vienna Road, Edgeley, Stockport; F. Taylor, 78, Vienna Road, Edgeley, Stockport. Remuneration as fixed by the company. Secretary: H. Taylor. Registered office: 56, Canal Street, Manchester.

Rowe, Hyde & Co., Ltd. (184,818).—Private company. Registered October 6th. Capital, £800 in £1 shares. To carry on the business of telegraph, telephone, radiographic, electric and general engineers, &c. The subscribers (each with one share) are: H. G. Cookson, 46, Airedale Road, Ealing, W.5, accountant; L. A. Anderson, 23, Fleming Road, Kennington, S.E.17, clerk. The first directors are: D. S. Rowe, H. A. Hyde and L. W. Gomer. Solicitor: W. A. Zabell, 11, Queen Victoria Street, E.C.

Markethill Electric Light & Power Co., Ltd. (N.I. 52).—Private company. Registered in Belfast September 29th. Capital, £2,500 in £1 shares. To carry on the business indicated by the title. The subscribers (each with one share) are: G. Marshall, Markethill, Co. Armagh, medical practitioner; J. Morgan, Markethill, Co. Armagh, merchant; W. Sinton, Markethill, Co. Armagh, merchant; Q. H. Edwards, Markethill, Co. Armagh, merchant. The first directors are: G. Marshall, J. Morgan, W. Sinton, W. H. Edwards, R. Doyle, R. Small, T. Willis, J. Mallagh and M. Curran. Qualification: 25 ordinary shares. Secretary: Geo. D. Taylor, F.S.I. Registered office: Markethill, Co. Armagh.

Irradiant Lamp Works, Ltd. (184,935).—Private company. Registered October 11th. Capital, £5,000 in £1 shares. To carry on the business indicated by the title and that of engineers, electricians, &c. The first directors are: R. C. Woolley, 39, Exeter Road, Brondesbury, N.W., A. R. Warner, 24, Upper George Street, W.1; J. D. Hauptman, 5, Broadhurst Gardens, Hampstead, N.W. Qualification: £1. Registered office: 4, Vernon Place, Southampton Row, W.C.

Charles Bell, Ltd. (184,925).—Private company. Registered October 11th. Capital, £15,000 in £1 shares (7,500 5 per cent. cumulative preference and 7,500 ordinary). To take over the business of a mechanical and electrical engineer carried on by Lazarus Bell at Bradford, Yorks., as "Charles Bell." The first directors are: Lazarus Bell, 1, Carlton Drive, Shipley (permanent governing director); Leonard Bell, 20, Redburn Drive, Shipley; H. H. Cassé, 11, Woodview, Manirgham, Bradford. Qualification of governing director: 1,000 of the shares to be allotted to him under purchase agreement. Remuneration of governing director: £600 per annum. Registered office: Iron Works, Bath Street, Leeds.

Ernest Mote & Co., Ltd. (184,980).—Private company. Registered October 12th. Capital, £2,500 in £1 shares (2,000 cumulative 10 per cent. participating preference). To adopt an agreement for the sale of all the property, undertaking and assets of Mote, Miller & Robinson, Ltd., and to carry on the business of merchants, manufacturers and agents of fancy or other articles in Erinoid, Galalith, bone, ivory, ebonite, vulcanite or other materials, &c. The permanent directors are: E. M. Mote, 18a, Blackheath Vale, Blackheath, S.E.3; A. Anderson, 5, Essex Court, Temple, E.C.4. The said E. M. Mote is first managing director at a remuneration (in addition to his remuneration as a director) of £260 per annum and a further 45 per cent. of the certified net profits remaining in any year after a dividend of 40 per cent. has been paid on the issued ordinary share capital. Remuneration of above named directors: 100 guineas each per annum; of other directors as fixed by the company. Registered office: 18a, Blackheath Vale, Blackheath, S.E.3.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Dictograph Telephones, Ltd.—Particulars of £15,000 debentures authorised July 10th, 1922, charged on the company's undertaking and property, present and future; the whole amount being now issued. (The debentures were dated July 10th, but executed September 18th, as appears from a statutory declaration by the secretary.)

T. Jackson, Sons & Co., Ltd.—First mortgage debenture, dated October 2nd, 1922, to secure £2,000, charged on the company's undertaking and property, including uncalled capital (if any). Holders: Bank of Liverpool and Martins, Ltd.

Thor Electric Safety Lamp Co., Ltd.—Particulars filed of £5,000 debentures authorised September 20th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Radio Appliances, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated September 11th, 1922, to secure £1,000. Holder: K. J. Hayward, Vicarage, Bruton, Somerset.

Acme Welding Co., Ltd.—Issue on October 4th, 1922, of £900 debentures, part of a series already registered.

Enterprise Manufacturing Co., Ltd.—Debenture dated September 29th, 1922, to secure £2,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. W. Abbott, 2, Roxburghe Mansions, Kensington Court, W.

Moodys, Ltd.—Debenture dated October 2nd, 1922, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: W. A. J. Osborne, Balfour House, 119, Finsbury Pavement, E.C.

Cox-Cavendish Electrical Co., Ltd.—Issue on September 20th, 1922, of £2,600 debentures, part of a series already registered.

Electrical Engineering (West Bromwich), Ltd.—Further charge on 402, High Street, West Bromwich, dated September 27th, 1922, to secure £1,300. Holders: T. A. Nightingale, 5, Bilhay Street, West Bromwich; and L. J. Nurse, Princess End, Tipton.

Ely Gas and Electricity Co., Ltd.—Issue on October 2nd, 1922, of £1,600 debentures, part of a series already registered.

Specialities (Liverpool), Ltd.—Debenture dated September 28th, 1922, to secure £500, charged on company's undertaking and property, including uncalled capital. Holders: Anti-Vibration Electric Lamp Co., Ltd.

G. H. T. Petersen (Engineers' Merchants), Ltd. (formerly Electric Pulley-Block Co., Ltd.).—Particulars filed of £2,500 debentures authorised September 19th, 1922, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,500.

Egham and Staines Electricity Co., Ltd.—First mortgage debenture dated September 25th, 1922, to secure £50,000, charged on certain land at Egham, Surrey, and company's undertaking and other property, including uncalled capital. Holder: The Treasury Solicitor.

CITY NOTES.

Marconi's Wireless Telegraph Co., Ltd.

The directors propose to raise additional funds by the creation of £3,000,000 short-term convertible debenture stock, of which it is intended to issue £1,500,000 forthwith, the balance remaining available for issue as and when circumstances may require. In a circular to the shareholders the directors state that the important developments of the company's business which have recently taken place, and the further developments which are pending, will involve considerable additional capital outlay. In particular the substantial business, both at home and abroad in broadcasting, though adding materially to the company's revenue, will call for considerable finance, at least for some little time to come. These proposals will involve an extension of the borrowing powers of the directors which are, at present, limited to one-half of the nominal amount of the issued capital, and also, in order to provide for conversion rights, an increase of the ordinary share capital of the company. An extraordinary meeting of the company was held to-day at the Connaught Rooms, for the purpose of passing the necessary resolutions, one of which provides for increasing the capital to £4,000,000 by the creation of £1,000,000 ordinary shares of £1 each.

Electrolytic Zinc Co., of Australia.

The report for the year ended June 30th states plant has been in operation for seven months only and the production represents relatively about one-fourth only of the estimated annual output with the full 30,000 h.p. Constructional work is approaching completion and the full plant, with an estimated output of 120 tons zinc daily, should be ready before January 1st next, when the full 30,000 h.p. should be available. Profit on the working accounts for seven months' operating, after allowing £29,000 for depreciation, was £93,841. After adding £1,492, income from property and sundry receipts, and deducting £12,789, the proportion of administrative expenses chargeable to productive operations, and providing £5,950 for income tax, the balance transferred to appropriation account is £76,594. Two dividends have been declared on the preference shares, totalling £76,518, leaving £28,298, or 6.1742d. per share of accrued dividend to June 30th, 1922, inclusive.

Drake and Gorham, Ltd.

The report for the year ended June 30th, 1922, shows that after payment of all charges and making provision for contingencies there is a profit of £4,005, plus £5,768 brought forward, and £3,669 reserved but not required for excess profits duty, making a total of £13,441. A dividend at the rate of 4 per cent. for the year requires £5,000; there is put to writing down goodwill to £15,000, £1,237; to special reserve, £3,750; and there is carried forward £3,454. "The past year has been unusually difficult owing to the over-taxed condition of those upon whom the company relies for lighting orders, and the stagnation in industrial concerns. There has been a considerable fall in prices during the past twelve months, and consequent reduction in installation costs; these are now unlikely to become lower, as trade generally is improving, and coal—which is the basis of all raw material prices—will probably rise in value. The company has been engaged in the development of broadcasting receiving sets, which are being manufactured at its works."

Eastern Telegraph Co., Ltd.

The annual meeting was held on Tuesday last at Electra House, Finsbury Pavement, Sir John Denison-Pender, G.B.E., K.C.M.G., in the chair. Proposing the adoption of the report, which was summarised in our last issue, the chairman said that he referred at the last meeting to the work on hand in connection with the laying of additional cables and the renewal of certain sections of main line cables. In addition to the £1,000,000 provided by the increased capital, they had since the armistice met out of the general reserve fund an additional sum of over £2,250,000. Up to the date of the accounts they had expended a further sum of £700,000, which would be dealt with at a later date, together with the balance of the cost of the new cables to be laid to complete the programme previously foreshadowed for strengthening their main lines to the Far East in conjunction with the Eastern Extension Co. When the whole work was completed it would place them in a very strong position and enable them to cope with a heavy traffic It would also provide sufficient capacity to deal in the same way with the increase in the volume of traffic which they hoped would result when the general trade of the world recovered its normal condition and automatically expanded with the reign of peace. He was glad to be able to say that the new cables already laid, the extensive renewals which had been carried out in some of the older sections, the introduction of additional automatic apparatus, and bringing the staff up to its normal complement, all of which were held up during the war, had had a beneficial effect in reducing the delay in the transmission of telegrams and had improved the system generally. They hoped to complete their programme early next year, when they would be in a position to deal satisfactorily with any eventuality that might arise. They had been working in close co-operation with the Post Office, acting on behalf of the various Government Departments and with India and South Africa, and it had been agreed to extend their landing licences for a period of 25 years subject to the right of the British Government to acquire by purchase the whole of their cables, plant, land and stations, &c., or such part as would be mutually agreed. They did not think that the Post Office was treating them fairly in the matter of competition for Australian traffic. Owing to the practical monopoly they had for the collection and delivery of telegrams at their offices all over the country they were actively supporting the Pacific Cable Board route against the company's route to Australia. To meet the abnormal expenditure on new cables, &c., they had realised part of their reserve fund investments, and incurred thereby a loss of £122,798, but as provision had been made in past years for the depreciation in the value of the securities, they withdrew £90,000 from that special fund and charged the balance of the loss against

the general reserve fund. There still remained £1,000,000 in the fund set aside as a provision on account of investment fluctuations, which at the date of the accounts was more than sufficient to meet the difference between the cost of the reserve fund investments and their value as at December 31st, 1921. They had been informed by the Indo-European Telegraph Co. that the latter hoped to have its line between Great Britain and Teheran restored shortly. This line, in conjunction with the Indo-European Telegraph Department's system *via* the Persian Gulf, would restore the alternative route to India, which was interrupted when war broke out. Mr. F. A. Johnson seconded the motion, which was carried without discussion.

German Companies.

The *Nassau Cable Works Co.*, of Halger, which was constituted in 1920, reports net profits of 713,000 marks for 1921-22, and a dividend at the rate of 20 per cent.

The *Brandenburg Carbide & Electricity Works Co.*, of Berlin, earned net profits of 1,280,000 marks in 1921-21, as contrasted with 810,000 marks in the previous year. The dividend is at the rate of 10 per cent., as in 1920-21.

The report of the *Rheydt Cable Works Co.*, of Rheydt, refers to the increases in the share capital to 84,000,000 marks, which were carried out in 1921-22, and states that the net profits amounted to 18,830,000 marks, as contrasted with 9,120,000 in 1920-21. It is proposed to pay a dividend at the rate of 20 per cent. and a bonus of 100 marks per share on 24,000,000 marks and 10 per cent. on 49,500,000 marks. A large number of uncompleted orders is stated to have been brought over into the new financial year.

Shropshire & Worcestershire Electric Power Co.—According to the *Financial Times*, an extraordinary meeting of this company is to be held on October 25th for the purpose of considering a resolution that the Severn Main Power Supply be a separate undertaking of the company. The capital and moneys authorised to be raised, 150,000 shares of £1 each, numbers 660,001 to 810,000 inclusive, and borrowing powers to the extent of £850,000 are to form the separate capital of the company in respect of the Severn Main Power Supply.

Zurich Electrical Bank.—The accounts of the Bank für Elektrische Unternehmungen, of Zurich, after the allocation of 3,012,000 fr. to the fund for uncovered differences in exchange, as compared with 2,086,000 fr. in 1920-21, show a surplus of 162,000 fr. for 1921-22, as against 112,000 fr. in the preceding year. Under the circumstances the shareholders remain without any dividend also for the past year.

Montreal Tramways Co., Ltd.—Accounts to June 30th show net income $524,004, out of which four quarterly dividends of 2½ per cent. have been paid, plus $916,709 brought forward. After deducting $198,388 for two deferred quarterly dividends on common stock to September 30th, 1919, the carry-forward is $844,983.

West African Telegraph Co., Ltd.—Gross revenue for 1921, £76,323; expenses, £46,521; profit, £29,801, plus £4,176 income tax refunded. £1,154 has been allocated to corporation tax charges, and £20,000 transferred to general reserve. After payment of dividend of 4 per cent., free of tax, £3,599 is carried forward.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—The profit for 1921 totalled £438,888, against £675,180 for 1920, plus £921,329 brought forward. The total dividend for the year on the ordinary shares amounted to 5 per cent., as against 10 per cent. for the previous year, and £832,092 is carried forward.

Costa Rica Electric Light and Traction Co.—It is stated that the directors have decided to pay fourth issue of deferred interest warrants, Serial No. 43, due July 1st, 1919, on November 1st, together with accrued interest for three years and three months to October 31st, 1922.

Victoria Falls and Transvaal Power Co.—The net earnings of the company, including those of the Rand Mines Power Supply Co., Ltd., for the quarter ended June 30th, 1922, amounted to £225,226, before providing for taxation.

Indo-European Telegraph Co., Ltd.—Interim dividend for the half-year ended June 30th at the rate of 5 per cent. per annum, free of tax.

Brazilian Traction, Light & Power Co.—The directors have declared a dividend of 1 per cent. on the ordinary stock.

Yates & Thom, Ltd.—Dividend of 7½ per cent. actual for the year; £50,000 to reserve, carrying forward £1,507.

Vera Cruz Electric Light, Power & Traction Co., Ltd.—Interim dividend of 5 per cent. actual on ordinary shares.

Cuban Telephone Co.—A dividend of $1.50 per share, less income tax, on the common stock is to be paid.

STOCKS AND SHARES.

Tuesday Evening.

The prospect of a General Election before the end of the year has not affected the Stock Exchange markets to any particular extent. Politics mix ill with finance, and the invariable result of a General Election is to unsettle men's minds, diverting their attention from the more practical things of life to the controversies of the rival political parties. Were there to be any general expectation of a return to power of the Labour party, the stock markets would probably show an easier tendency, but in the majority of cases, prices are well maintained, and there is a lot of business doing in the popular favourites. So far as investment values are concerned, these are well held, and in the big markets, the only section to show any languor on account of public neglect is that for Home Railway stocks.

Undergrounds are easier on the week, falls having occurred in Metropolitan ordinary, District and Underground shilling shares. So far as the trunk lines are concerned, this week's conference of managers in connection with fare revision is not viewed with any particular favour, since nobody can tell what effect a reduction in charges would be likely to have upon dividends. Nothing more has been heard of the possibility of the South-Eastern Railway starting its anticipated scheme for extensive electrification, nor is it thought that any announcement will be made until after the terms of the grouping of the Southern railways have been made public.

It was an unpleasant surprise for Marconi shareholders to be informed that the company intends to take powers for the immediate issue of 1¼ million debentures, convertible into shares. Before this was known, the price of Marconis hardened a trifle over 50s.; the announcement caused a drop to 2 5/16, from which a recovery to 2 7/16 ensued. On Friday in this week, the directors meet the shareholders in order to lay before them full particulars of the board's intentions, when, no doubt, a comprehensive speech from the chairman will clear up some of the points upon which there is at present confusion and uncertainty.

The mild boom in broadcasting, especially amongst those who like to dabble in electrical matters, continues throughout the country, but it has not attained anything like the dimensions to which it has risen in America. New York, according to an American just over, has dozens of broadcasting stations. In the circumstances, it is not surprising that Radio Corporations should have been in demand in New York. The price has risen to 22s., the preferred being stationary at 14s. 9d.

Several of the Eastern stocks and shares are decidedly better, though the improvement is not particularly noticeable in the official quotations. There is, however, a demand for Eastern ordinary, Extensions, and Westerns. In other cable issues, the market is as quiet as usual.

Charing Cross ordinary shares are ¼ up at 7¼. County ordinary has recovered to 28s. 9d., and the new shares are a little better at 3s. premium; the preference keep firm at 2s. premium. Metropolitans continued their advance, and stand now at 6¼. South Londons have been dealt in round about £4 per share, and Londons are in anxious demand up to 56s. 3d. Westminsters have begun to move up again, and now command 7¼. The strength of the market is pronounced.

Anglo-Argentine Tramways, after a prolonged period of neglect, have come to life, and the first preference at 3¼ show a rise of 5s. The seconds are steady at 3¼. Brazil Tractions rose to 49, on the announcement of what is now coming to be regarded as the usual quarterly dividend of 1 per cent. The preferred, however, drooped to 90¼. In British Columbia Railways, the preferred stock at 68 is 2 points higher. Mexicans are also a little better, a gain of 2¼ to 42¼ in Mexico Trams seconds being the outstanding feature. The news from the country, however, is still meagre, and bondholders in its utility companies begin to get restive about the long suspense.

Babcock & Wilcox at 3 1/16 are ¼ up, favourable rumours being circulated with regard to the next dividend. Iron and steel shares generally are a little better. Armstrongs advanced upon the announcement of a substantial new contract. Callenders rose to 2¼, and British Insulated ordinary at 43s. 3d. are 6d. lower. Cromptons, although quoted at 15s., changed hands at 18s. 9d. the other day, the same price, by the way, to which English Electric preference have drooped. No further change has occurred in Metropolitan-Vickers preference or other of the manufacturing companies' shares.

The rubber market has come along with a rush. The popular fancy, stirred by the possibility of rubber rising

once more to 1s. and over per lb. has gone "all out," in order to be early in the field with purchases of the better-class shares. In the excitement, practically everything has been advanced, and the burning question of the moment is whether this is going to be maintained or not.

British Electric Traction ordinary at 59⅛ is 1⅛ higher. The 6 per cent. participating preference stands at 90½, the 5 per cent. perpetual debenture having gone back to 89½. London and Suburban Traction preference have improved to 9s. 3d. Shanghai Electric Construction ordinary shares are 10s. better at 19½, and Yorkshire West Riding ordinary at 15s. have gained a shilling.

On the other hand, Para Electric Railway 5 per cent. first debenture stock has fallen to 52½; Midland Counties Electric ordinary at 15s. 6d. and the 7½ per cent. mortgage debenture stock at 102 are both slightly better. New Midland Electric 7 per cent. preference have gone back to 21s. 3d, Newcastle-on-Tyne 5 per cent. preference to 14s. 6d., though the last-named company's debenture stocks have improved to 90½ for the 4½ per cent. first debenture, and 104 for the 6 per cent. second debenture. North Metropolitan preference are in request up to 21s. 3d. Notting Hill ordinary remain at 2½, the 6 per cent. preference at 9½ showing a rise of the fraction on the week. South Metropolitan ordinary went back to 27s. 6d., Urbans to 22s. 6d. The 4½ per cent. first debenture stock of the latter company has gained 4½ points at 70, and Yorkshire Electric 5½ per cent. debenture stock at 101 is slightly better. These prices are mentioned because they do not occur in a good many of the share-lists that are published, and the market in most of them, being restricted, alterations are liable to be overlooked by those who are interested.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1920.	Dividend 1921.	Price Oct. 17, 1922.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	12	12	8⅜	—	£7 1 2
Charing Cross Ordinary	8	9	7⅞	+ ⅛	6 0 0
do. do. do. 4½ Pref.	4½	4½	4	—	5 12 6
Chelsea	6	6	6½	+ ½	4 12 4
City of London	14	14	2⅜	—	6 18 0
do. do. 6 per cent. Pref.	6	6	23/-	—	5 4 4
County of London	8	8	1⅞	+ 1/16	5 11 4
do. do. 6 per cent. Pref.	6	6	1⅛	—	5 4 4
Kensington Ordinary	9	10	7½	—	6 13 4
London Electric	2½	4	2⅝	—	4 11 5
do. do. 6 per cent. Pref.	6	6	5	—	5 17 1
Metropolitan	7	7	6½	+ ½	5 12 0
do. 4½ per cent. Pref.	4½	4½	4	—	5 12 6
St. James' and Pall Mall	12	12	9½	—	6 11 6
South London	7	7	4	—	7 0 0
South Metropolitan Pref.	7	7	1⅜	—	5 18 0
Westminster Ordinary	10	10	7½	+ ½	6 9 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref	6	6	102	—	5 17 8
do. Def.	1½	84/6	22½	—	7 8 6
Chile Telephone	6	6	6	—	5 0 0
Cuba Sub. Ord.	7	7	8¼xd.	—	6 12 4
Eastern Extension	10	10	18⅜	+ ⅛	5 6 8
Eastern Tel. Ord.	10	10	186½	+2	5 7 3
Globe Tel. and T. Ord.	10	10	18½	—	5 6 8
do. do. Pref.	6	6	11½	—	5 4 4
Great Northern Tel.	24	22	29½	— ½	7 15 6
Indo-European	10	10	85½	+1	7 1 0
Marconi	25	15	2⅞	+ 1/16	6 3 0
Oriental Telephone Ord.	12	12	23	—	£5 1 1
United R. Plate Tel.	8	8	6⅜	—	£5 16 0
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18½	—	£5 8 1
Home Rails.					
Central London Ord. Assented	4	4	67	—	5 19 5
Metropolitan	1½	2½	53½	−3½	4 5 9
do District	Nil	1	40	−1	2 10 0
Underground Electric Ordinary	Nil	Nil	3½	—	Nil
do. do. "A"	Nil	[Nil	7/6	−6d.	Nil
do. do. Income	2	4	86½	+1	£4 12 7
Foreign Trams, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	8⅝	+ ¼	7 11 9
do. do. 2nd Pref.	Nil	5½	8¼	—	7 2 0
do. do. 5 per cent. Deb.	5	5	80½	—	6 4 8
Brazil Tractions	Nil	Nil	49	+ 2	8 3 4
British Columbia Elec. Rly. Pcc.	5	5	70½	—	6 9 9
do. do. Preferred	6	90/-	68	+2	£7 0 0
do. do. Deferred	8	124/-	71½	—	£8 12 6
do. do. Deb.	4½	4½	75xd	—	5 18 4
Mexico Trams. 5 per cent. Bonds	Nil	Nil	72½	+2	7 1 10
do. do. 6 per cent. Bonds	Nil	Nil	49½	+2½	Nil
Mexican Light Common	Nil	Nil	19⅜	—	Nil
do. Pref.	Nil	Nil	49½	—	Nil
do. 1st Bonds	Nil	5	65½	+1	7 14 6
Manufacturing Companies					
Babcock & Wilcox	15	15	3⅛	+ ⅜	5 4 0
British Aluminium Ord.	10	5	17/9	—	5 12 8
British Insulated Ord.	15	15	43/3	−6d.	6 18 7
Callenders	15	15	2½	+ 1/16	6 13 4
" 6½ Pref.	6½	6½	1⅜	—	5 15 7
Crompton Ord.	10	5	18/-	—	5 18 4
Edison-Swan	10	Nil	8/-	—	Nil
do. do. 5 per cent. Deb.	5	5	64	—	7 16 4
Electric Construction	10	10	25/6	—	7 17 0
English Electric	8	5	15/0	—	6 7 0
do. do. Pref.	6	6	18/9	— 9d.	6 8 0
Gen. Elec. Pref.	6½	6½	21/3	—	6 2 4
do. Ord.	10	5	18/6	−6d.	5 8 1
Henley	15	15	2½	—	6 9 10
do. 4½ Pref.	4½	4½	4½	—	5 2 10
India-Rubber	10	—	⅛	—	—
Met.-Vickers Pref.	8	8	23	— ½	6 14 9
Siemens Ord.	10	10	25/9	—	£7 15 4
Telegraph Con.	20	20	20½	—	£4 13 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

Wednesday, October 18th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... per lb.	7½d.	...
a Ammoniac, Sal ... per ton	£63	...
a Ammonia, Muriate (large crystal) ,,	£48	...
a Bisulphide of Carbon ... ,,	...	...
a Borax ... ,,	£30	...
a Copper Sulphate ... ,,	£26 10s.	...
a Potash, Chlorate ... per lb.	5d. to 5½d.	...
a ,, Perchlorate ... ,,	7½d.	...
a Shellac ... per cwt.	£14 15s.	...
a Sulphur, Sublimed Flowers ... ,,	£9 10s.	20s. dec.
a ,, Lump ... ,,	£8	£2 dec.
a Soda, Chlorate ... per lb.	3½d.	...
a ,, Crystals ... per ton	£6	...
a Sodium Bichromate, casks ... per lb.	5d.	...
METALS, &c.		
b Aluminium, Ingots ... per ton	£100	...
b ,, Wire ... per lb.	1/9 to 2/6	...
b ,, Sheet ... ,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... per ton net	£159	£5 inc.
Grade II ... ,, ,,	£114	£3 inc.
Grade III ... ,, ,,	£65	£2 inc.
c Brass (rolled metal 2" to 12" basis) per lb.	9½d.	...
c ,, Tubes (solid drawn) ... ,,	11¾d. to 1/-	...
c ,, Wire, basis ... ... ,,	9¼d.	...
c Copper Tubes (solid drawn) ... ,,	1/1½	...
c ,, Bars (best selected) ... per ton	£96	...
c ,, Sheet ... ... ,,	£96	...
c ,, Rod ... ... ,,	£96	...
d ,, (Electrolytic) Bars ... ,,	£71 15s.	15s. dec.
d ,, ,, Sheets ... ,,	£145 10s.	...
d ,, ,, Wire Rods ... ,,	£81 15s.	15s. dec.
d ,, ,, H.C. Wire per lb.	10/16d.	1/16d. dec.
f Ebonite Rod ... ... ,,	3/6	...
f ,, Sheet ... ... ,,	3/-	...
n German Silver Wire ... ... ,,	2/6	...
h Gutta-percha, fine ... ... ,,	12/6	...
h India-rubber, Para fine ... ,,	1/-	1½d. inc.
i Iron Pig (Cleveland Warrants) ... per ton	92s. 6d. to 95s.	...
i ,, Wire, galv. No. 8, P.O. qual. ,,	£24	...
g Lead, English Pig ... ... ,,	£26 10s.	5s. inc.
g Mercury ... ... per bot.	£14 10s.	15s. dec.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ... ,,	4/- to 8/-	...
e ,, ,, large ... ,,	10/- to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/1	...
p ,, drawn bars and rods ,,	1/3	...
p ,, rolled strip & sheet ,,	1/3½	...
p ,, wire ... ... ,,	1/3½	...
o Platinum ... ... per oz.	£26	...
d Silicium Bronze Wire ... ... per lb.	1/1	...
r Steel, Magnet, in bars ... ,,	1/-	...
n Tin, Block (English) ... ... per ton	£170 10s.	£7 15s. inc.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/-	...

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

London Electrical Engineers.—After an interval of four years the old headquarters of the London Electrical Engineers has once more assumed its normal appearance and recruiting is in full swing. The unit forms the Searchlight Contingent of the 3rd Air Defence Brigade, whose *rôle* is the defence of London against aircraft. It has an establishment of about 800 all ranks, under the command of Lieut-Col. K. Edgecumbe, who, it may be added, joined the London Electrical Engineers as a sapper nearly 25 years ago. The conditions of service are practically the same as they were in pre-war days, except that the pay and allowances are on a considerably more liberal scale. Application for further particulars should be made to 46, Regency Street, Westminster, between the hours of 6 and 8 p.m. on any week-day except Saturday.

The London Electrical Engineers Old Comrades' Association is holding the final concert of the 1921-22 season at the Bridge House Hotel this (Friday) evening, when full particulars of the new unit will no doubt be announced.

Unemployment Returns.—The Labour Ministry reports that on September 25th there were 1,319,900 persons registered at the Employment Exchanges in Great Britain as wholly unemployed. The corresponding figure for September 18th was 1,321,667, an increase of 3,190, as compared with September 11th, and on September 25th a decrease of 1,767, as compared with September 18th. The total for September 25th was 508,833 less than at the beginning of last January. The number working short time and drawing benefit for intervals of unemployment was 58,900 on September 25th, as compared with 58,902 on September 18th, and 934,786 on July 1st, 1921.—*The Times.*

THE WIRELESS EXHIBITION.

The First All-British Show.

(*Concluded from p. 534.*)

The Metropolitan-Vickers Electrical Co., Ltd., had a display of "Cosmos" radiophones, including crystal and valve sets, note amplifiers and loud-speaking attachments. The firm has devised a mains attachment to enable a d.c. supply from the house mains to be used and thus avoid batteries and dry cells in connection with valve sets. A feature of the exhibit was the scale model of the well-known Metropolitan-Vickers water tower, aerial, and mast by means of which the firm's experimental work is done. The smallest type of radiophone made by the firm will enable the user to hear anything from a broadcasting station situated within a radius of approximately ten miles. Material for the aerial and earth system is provided with these sets. The receiving instrument consists essentially of a tuner, detector, and a telephone, to which is added the aerial outfit. The tuner consists of a variometer made up of two coils of insulated wire mounted concentrically, one of which can be turned with respect to the other by a handle into any position so that the current in the turns of the moving coil either opposes or assists that in the stationary coil. A series condenser is provided with alternative aerial terminals arranged so as to permit equally satisfactory tuning on either a long or short aerial. The tuning handle operates over a graduated scale, and a slot is provided in the pointer through which this scale can be marked by the operator to show the tuning position for any particular station. This mark will enable the same station to be easily picked up on future occasions. The detector is of the crystal type, and a spare crystal is provided with each set. No batteries are required.

The whole of the apparatus is completely self-contained in a neat wooden case in which there is also space to pack away the head telephones when not in use.

The "Cosmos" valve set has a radius of approximately fifty miles, using head telephones, and this range may be

Fig. 9.—Frame Aerial Cabinet Receiver.

increased by the addition of an amplifying unit up to about 200 miles, or for distances up to about fifty miles a loud-speaking telephone can be used. In accordance with the regulations laid down by the Postmaster-General, the "Cosmos" valve sets are not fitted with reaction circuits and are incapable of generating oscillations in the aerial.

The set consists of a compact two-valve receiving and amplifying unit, comprising a tuning variometer, one high-frequency amplifying valve and one rectifying valve, and a filament regulating rheostat, all mounted in a neat hard-wood case, together with batteries and a pair of high-resistance head-telephones. Material for the aerial and earth system is provided with each set. The tuning variometer has all the features of the crystal set. The valves are of the Mullard "Ora" type, and are interchangeable.

Residents in flats, hotel apartments, and places where the erection of an aerial is out of the question will be interested to learn that a complete receiving set enclosed in a cabinet without any external wires or connections of any kind has been designed by Radio Instruments, Ltd. The receiver, of which fig. 9 is an illustration, comprises a 7-valve set with a frame aerial fitted to the lid of a cabinet of period or other design in which is included a loud speaker and the necessary high- and low-pressure batteries, the latter being accommodated in a cupboard in a lower part of the cabinet. To receive broadcast telephony it is only necessary to open the lid of the instrument and to manipulate three knobs which control the tuning circuits. Doors are fitted to the loud speaker which can be opened or closed thereby reducing or increasing the sound as required. Three high-frequency intervalve transformers fitted with tapping points on the windings and controlled by a coupled switch for simultaneous operation, are connected with the first three valves; the fourth valve acts as a detector, the last three valves being coupled through audio-frequency transformers. The frame aerial in the lid is hinged so that it can swing through an angle of 90 deg. for obtaining the maximum volume of sound according to the direction of the transmitting station.

The Dubilier Condenser Co. (1921), Ltd.—This firm's products are too well known to need any introduction, but a novel pattern of variable air condenser (known as the "Sphericon") was shown, in which the electrodes are in the form of hemispherical shells, fixed and movable shells being interleaved with one another somewhat similarly to the arrangement of the moving-vane condenser. This arrangement secures great mechanical rigidity and ensures constancy of calibration.

An apparatus of special interest which was also exhibited, is a device for enabling the ordinary house electric lighting wires to be used as radio receiving aerials. In the ordinary way it is not possible to utilise the house wiring as a receiving aerial without first switching off the current at the main switch where it enters the building, as otherwise a short circuit would result and the receiver would be damaged. The use of the "Ducon" attachment obviates this. It is tested to withstand 2,000 volts so that safety is assured with no possible risk of shocks when handling the apparatus with the current switched on. The attachment is designed for inserting directly into an electric lamp-holder and is provided with terminals for attaching a wire to the aerial terminal of the receiving apparatus.

The Automatic Telephone Manufacturing Co., Ltd., exhibited a range of practical accessories. The method of securing the A.T.M. telephones to the headbands is worthy of note. This permits of instantaneous adjustment and, combined with the absence of weight, makes the set comfortable to wear.

In spite of their simplicity crystal receivers suffer from the disadvantage that the tuning adjustment has to be made simultaneously with the adjustment for finding the most sensitive point on the crystal. Consequently, crystal sets are sometimes rather puzzling to the novice. It will be readily appreciated that a crystal receiver in which the detector is always automatically set in its most sensitive position and requires no adjustment of any kind, constitutes a big advance.

The T.M. Co. has produced and patented such a detector. The principle of this new detector is roughly that instead of depending on means to find one sensitive point on the crystal, a number of points of contact are always available, consequently this particular detector is automatic in its adjustment as one of the points of contact can be relied upon always to provide the necessary rectifying action.

This new detector is made up in cartridge form like a small fuse, and is held between two clips.

On this stand was also displayed a range of "Radiak" products manufactured by the Ashley Wireless Telephone Co., Ltd., including receiving apparatus. The "Radiak" 1 to 5 valve unit system will appeal to the enthusiast on account of the easy way in which it is possible to add a unit at a time just as one would add to a sectional bookcase.

Mr. H. W. Sullivan had on view an improved crystal receiver (patents applied for) that has been designed with a view to simplicity, efficiency, and reliability. By means of a switch the set is adapted for use on aerials varying in dimensions and shape; the operation consists of only one adjustment—for tuning. A sensitive and robust type of crystal, which requires no extreme delicacy of adjustment, is employed. This receiver forms a miniature nucleus cabinet complete in itself, but to which note magnifier cabinet units may be added (unit system) at will to increase the strength of reception and to enable many telephone receivers to be used.

The high-power amplifying receiver cabinet for all wave-lengths is a self-contained receiver (fig. 10), to which the aerial and earth leads are brought direct, the only

additional apparatus required being the batteries and telephones, or loud speaker. Two separate sets of tuning adjustments are employed, one for wavelengths up to 4,000 metres, and the other for wavelengths from 4,000 to 20,000 metres. The change from short wavelength reception to long wavelength reception is effected by means of a simple change-over switch. The short-wave range brings in broadcast transmission, the Eiffel Tower Paris concerts, The Hague concerts, as well as the Marconi (Writtle) and amateur transmissions. The long-wave range of adjustment tunes to the long-distance trans-oceanic radio-telegraphic traffic. The

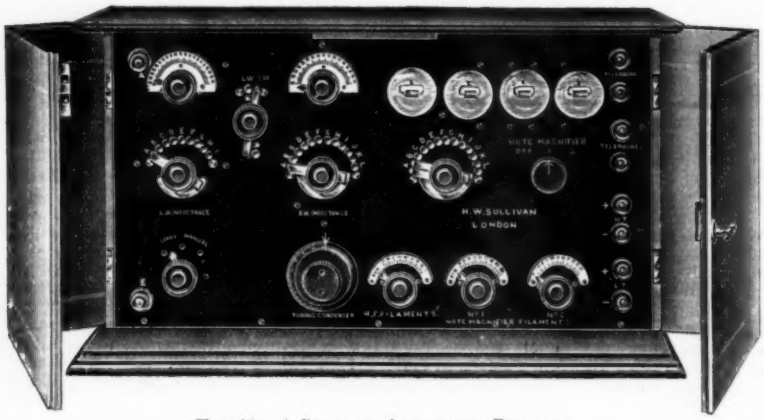

Fig. 10.—A Sullivan Amplifying Receiver.

amplifier portion of the receiver employs four valves, the first of which functions as a high-frequency amplifier, the second as a detector, and the third and fourth as note magnifiers. This combination gives powerful magnification, and a multi-functioning switch is provided to cut out one or two valves in order that very loud speech and signals may be more comfortably and economically received. The set is mounted in a cabinet, which measures 28 in. by 13 in. by 16 in. high. A self-contained 4-valve cabinet, similar to

Fig. 11.—A Sullivan Heterodyne Wavemeter.

the above, but smaller and much simplified, is being designed specially for broadcast reception.

The Sullivan standard heterodyne wavemeter (150-20,000 metres) is claimed to be the first of its kind produced for commercial use, and is a self-contained standard for precision measurements of continuous and spark waves. The instrument (fig. 11) is accurately calibrated against an N.P.L. standard and a full range of seven calibration curves is supplied.

The radio telephone transmitting set (10-50 watts) is suitable for wavelength ranges of 150-200 or 440 metres. It is a self-contained set ready for attachment to the aerial. The aerial oscillatory circuit is loosely coupled to a primary oscillating circuit, the tuning for both circuits being conveniently arranged in the set. A system of speech control is adopted which gives, on this power, very clear modulation.

The following firms also exhibited:—

The Wireless Supplies Co.—"Crystophone" receivers, cowl insulators, "Multicryst" crystals.

The Anode Wireless and Scientific Instruments, Ltd.—Crystal and valve receivers, batteries, condensers, &c.

The Zenith Manufacturing Co.—Valve receivers, rectifiers, resistances, transformers, &c.

The Radio Service Co., Ltd.—Valve and crystal sets, and accessories.

The "K.B." Radio Equipment Co.—Accessories and component parts.

Mr. T. H. Isted.—Crystal and valve receivers, amplifiers, and accessories.

Fellowes Magneto Co., Ltd.—"Fellocryst" and "Fellophone" valve receivers and accessories.

The Ever Ready Co. (Great Britain), Ltd.—Dry cells and accumulators.

Messrs. Hambling, Clapp & Co.—"O.K." portable crystal receiver and accessories.

Messrs. Burndept, Ltd.—Transmission and receiving sets for experimental use; accessories.

The Wireless Equipment, Ltd.—Crystal and valve receivers and accessories.

Messrs. Wates Bros.—Valve receivers, "Sphinx" batteries, "Ideal" accumulators, &c.

Messrs. Peto Scott Co.—Crystal and "unit" receivers and components.

The Hart Accumulator Co., Ltd.—Batteries and accumulators.

Messrs. J. A. Coomes & Co., Ltd.—"Ionophone" receiver, "Hightensite" specialities, &c.

Messrs. J. B. Bower & Co., Ltd.—Crystal and valve receivers, condensers, high frequency machines, glass electrodes, instrument wire, &c.

Messrs. Mitchell's & Wireless, Ltd.—Crystal and valve receivers, dynamos, motors, transformers, "Lokap" coil-winding machines, and components.

Messrs. Rogers, Foster & Howell, Ltd.—"All-on" valve sets, knapsack receivers for tourists, crystal sets, and parts.

Mr. W. R. H. Tingey.—Receivers.

The General Radio Co.—Cabinet-type receiving sets, portable crystal sets, loud speakers, variometers, varicouplers.

Messrs. A. C. Cosser, Ltd.—Valves and accessories.

Messrs. W. A. Gamage, Ltd.—Valve and crystal sets, and parts.

Messrs. H. P. R. Wireless, Ltd.—Tuners, amplifiers, magnifiers, valve detectors, "Simplex" receivers.

Messrs. Leslie McMichael, Ltd.—Valve and crystal sets and accessories.

The Western Electric Co., Ltd.—Cabinet valve sets, crystal receivers, loud speakers, aerials, &c.

The British Wireless Supply Co., Ltd.—"Britwire" receivers, coils, &c.

Messrs. S. G. Brown, Ltd.—Telephones, loud speakers, microphone amplifiers.

Messrs. Alfred Graham & Co.—Loud speakers, telephones, microphones, transformers, &c.

Messrs. G. Z. Auckland & Son.—Accessories.

Messrs. Gambrell Bros., Ltd.—Crystal and valve receivers and components.

The Econ Manufacturing Co., Ltd.—Receivers, insulators, aerials, and lightning conductors, &c.

The Economic Electric, Ltd.—Receivers, accessories, "Xtraudion" valves, &c.

Messrs. Pettigrew & Merriman, Ltd.—Crystal and valve sets, "Gramaphix" for loud speakers, and accessories.

Messrs. H. Stanley Prince & Co.—Crystal and valve receivers.

Miners' Electric Lamps in Australia.—Coalminers' representatives from the northern, southern, and western districts of New South Wales, Australia, waited upon the Minister for Mines (Mr. J. C. L. Fitzpatrick) recently, and asked him to assist miners to use electric light in the mines. The deputation accepted the Minister's suggestion that a conference should be held. Mr. D. Rees, president of the Coalminers' Federation, said that the old type of oil lamp was mainly responsible for the large number of miners who were incapacitated annually by nystagmus. Electric lamps would be more efficient and would reduce this disease by at least 25 per cent. Mr. Fitzpatrick: "It is admitted that there should be a change in the system of lighting; the only thing is how that change can be brought about. Several collieries are investigating the matter of electric lamps."

SALESMANSHIP IN RELATION TO LIGHTING.

The first of a series of lectures organised by the British Electrical Development Association, following on the success of last year's lectures, was given by Mr. W. E. Bush, of the British Thomson-Houston Co., Ltd., at Caxton Hall, on October 13th. Mr. Ll. B. Atkinson (Chairman of the E.D.A.) was in the chair, and the attendance was even larger than most of the attendances last year.

The lecturer confined himself to dealing with the business to be obtained in modernising and adding to existing lighting equipments, as distinct from the development of entirely new business, which was dealt with last year in a lecture by Mr. Haydn Harrison. The branch of the business which Mr. Bush dealt with he considered badly neglected. Generally speaking, he regarded the progress in the sale of good lighting during recent years, in spite of the vast amount of publicity given to it, as very slow, which was probably due, in a large measure, to the apathy shown to the merchandising side of the business by the retail trade. The lecturer stated that, in his opinion, only 30 per cent. of the factories of the country had proper lighting equipment; 60 or 70 per cent. of our shop windows needed new gear; in the majority of shops the internal equipment was obsolete and inefficient, and the intensity of illumination hopelessly inadequate; and the majority of private houses had been wired for the minimum number of outlets for the use of electricity, and equipped with the simplest forms of lighting apparatus. One important reason why, the speaker said, was that there was a lack of first-rate lighting salesmen, and it would pay handsomely if contractors and supply authorities would send their salesmen periodically to the manufacturers for instruction. He did not suggest that the lighting salesmen should have an extensive theoretical training in the design of equipment, but a short course covering the demonstration of lighting fundamentals and instruction in simplified methods of designing illumination.

As to the market available, the lecturer said that extraordinary care was taken to see that the generating plant was of the highest possible efficiency, but when it came to lighting it was considered sufficient to state the number of "points" without regard to efficiency. When the points were installed it was often left to the manager, or even the workmen, to fit them with lamps and shades to suit their particular fancies. In the lighting industry appliances installed 30 years ago were still in use, and, worse still, similar apparatus was being installed to-day. It could be proved that modern installations of high-intensity lighting increased production from 15 to 20 per cent., thus easily paying for the installation and operating costs. An installation was mentioned in which 200-watt lamps with industrial reflectors had been installed at 10-ft. centres, giving an intensity of illumination approximating to daylight. In the old system, which these lamps replaced, 30 kW for local lighting was used. With the new system 150 kW had been installed, so that all branches of the industry, central station, manufacturer and contractor, would benefit. The same charge of obsolescence of much of the equipment of offices and public buildings was made. In all directions the endeavour should be made to educate the public to an appreciation of higher illumination intensities. As in offices and public buildings, so in shops; the shopkeeper must have new and modern appliances brought to his notice or he would not otherwise be made aware of them. The aim should be to light every window like a stage, sometimes introducing artistic colour effects, spot lighting, and other attractive combinations. Inside, thousands of small shops required properly lighting. Incidentally, it was urged that an attempt should be made to popularise the term "foot-candles" amongst the users of electric lighting apparatus. Numerous directions were indicated in which new business was available, i.e., in churches and public buildings, and in the home, the latter presenting the greatest opportunity of all, and the general arguments applied to schools, theatres, &c. A sales campaign was outlined, by which consumers should be canvassed first by post ,and immediately afterwards by calls from salesmen. After disagreeing with the view often expressed that nowadays lighting could look after itself and that the heating and cooking load should be developed mostly, Mr. Bush made a strong criticism of the trade Press. His words were as follows: "Before concluding I would make an appeal to the electrical Press to give the question more prominence and help to foster greater interest in merchandising light. Our trade journals devote plenty of space and attention to developments of a scientific and technical nature, but when it comes to purely commercial matters it is not easy to secure their interest. The editorial departments of these papers seem to look upon the electrical industry as a kind of subsidised organisation engaged primarily in abstract research. What we want is that our papers should frankly commercialise themselves and deal at greater length with what is, after all, the main concern of the industry, the sale of its products. I do not mean simply by the publication of trade 'puffs,' but rather by a definite diversion of editorial policy from technics to trade. Let the papers investigate, propound, and develop new selling ideas for the benefit of their trade readers. In the domain of lighting there is enough scope for journalistic enterprise. It is a subject which has never adequately been treated."

Finally, he said that we were just entering upon a new lighting season; the market was waiting and the goods were ready. What was required was the enthusiastic co-operation of contractors, supply companies, and manufacturers, backed up by the E.D.A. and the trade Press.

In a subsequent discussion the Chairman drew attention to the importance which the E.D.A. attached to the whole question of salesmanship, and said that the industry had suffered more from inefficient and insufficient salesmanship than from any other single defect.

Mr. W. E. Rogers (Electricity Department, West Ham) said that, speaking from the electricity supply point of view, supply authorities had had to turn to the development of the power load in order to improve their load factors and make the business pay.

Mr. Joyce appealed for co-operation between supply authorities, manufacturers, and contractors, and for their support of the E.D.A., which body should carry out the propaganda work on behalf of all of them.

Mr. E. Stroud emphasised the importance of educating the salesmen and the public, and asked that manufacturers of lighting appliances should publish distribution curves.

Mr. L. L. Robinson (Borough Electrical Engineer, Hackney) said that he objected to salesmen talking to the consumer about foot-candles, and so on. They should talk to him in a practical manner and show him what was wanted.

Mr. H. W. Gregory did not quite agree. They should try to educate the consumer, to a certain extent, as to what a foot-candle was, and he suggested that there should be a photometer or a similar instrument in every showroom for the free use of any consumer or prospective consumer.

Mr. W. E. Warrilow agreed with Mr. Robinson. Referring to trade discounts, he said that it seemed to be possible for anybody who bought a lamp to get a trade discount, whether from the manufacturer, the factor, or the contractor. As to education on lighting, he advised that they should start in the schools, and so educate the light user from the beginning. The question was the sale of light, and not merely the sale of lamps. They must also educate architects on lighting, and ask them to attend the conferences. He asked Mr .Bush if he had heard of an insurance company giving a special rebate in a works so well lighted that accidents were greatly reduced. Such a rebate would be of great value to the lighting salesman.

Mr. Mann, dealing with trade discounts, said that manufacturers allowed varying discounts, which resulted in contractors pushing the sale of those articles which gave them most profit. Therefore discounts should be standardised, and contractors would feel that they were pushing articles on their merits. He agreed that it was difficult to explain to the consumer the meaning of such expressions as "foot-candles," and appealed for simplicity.

Mr. H. T. Young said that supply authorities, manufacturers and contractors were not pulling together, and they must come to a definite decision as to the function of each. He had found that when a man wanted an odd lamp or some fuse wire he went to the contractor, but when he wanted something more the manufacturers were after him. The contractor must be given a chance to sell his goods, and must be given reasonable trade terms for the work he did. He agreed that it was desirable to send out circulars, but they must be followed up. It was important, when trying to convince a man that it would be better to have his lighting rearranged, to offer to fit it up for him as an experiment, and in 99 cases out of 100 the client would keep it and pay for it. He emphasised the importance of holding staff conferences, so that the men could make suggestions to clients with whom they came in contact; and, finally, called attention to the fact that money was saved on decorations where electric lighting was installed, as compared with gas.

Mr. W. F. T. Pinkney (Newcastle) said the whole tone of the conference at Newcastle on the previous evening was co-operation, and emphasised the need for it. He suggested that wiremen, meter readers, &c., should be trained in salesmanship.

Mr. Stephens said the manufacturers recognised the need for co-operation as much as the contractors. He suggested that the industry should arrange one or more electrical weeks, when co-operative efforts should be made by the whole industry to "boost" electric lighting.

Mr. H. J. Cash pointed out that contractors were afraid of the manufacturers taking their business, and asked that manufacturers and contractors should investigate the cause together. The E.D.A. could help more by drafting sales letters and offering them to contractors. He suggested that it would be cheaper to convince a shopkeeper that he needed better lighting by fitting up an installation free of charge for a year (the supply authorities supplying the energy, the manufacturers the fittings, and the contractors the wiring) than by argument.

Mr. R. B. T. Pinkney asked that manufacturers should help to extend the knowledge of salesmen by supplying blue prints of illumination curves, &c. He welcomed the suggestion made recently in the Electrical Review that contractors should combine together and run showrooms jointly.

A speaker deprecated the suggestion that wiremen and meter readers should be trained in salesmanship, because they would have to be given commission on sales, and would take more interest in that than in their real job.

Mr. R. W. Hughman (*Electrical Times*) urged that the idea of salesmanship should be kept in mind at the conferences, or they would fail in their object to a large extent. They should talk about selling points, and leave trade discounts and other matters alone.

Mr. A. Gowans Whyte (*Electrical Industries*) considered Mr. Bush's criticism of the electrical Press as ingratitude.

Mr. Bush, in reply to the discussion, said that America was making great efforts to increase the lighting load; if it paid there why not here? Distribution curves would probably not be appreciated. He believed in giving contractors more cut-and-dried information. He defended his advocacy of the use of the term "foot-candles," and said they must have some method of measuring, or they would not know what light they were getting. Salesmen should offer the architect more elaborate schemes, with which he was not competent to deal. He had done that himself, and architects had had to come to him for advice. He did not know of an insurance company giving a special rebate for a well-illuminated works, but had read that such things were done in America. With regard to trade discounts, his company did its utmost to prevent those who were not entitled to discount from getting it, but mistakes might happen sometimes. On these questions of discount and trade conditions he suggested that at these conferences they should settle matters of policy, and, having agreed upon those, let their trade organisations settle the details. He agreed with the training of wiremen and meter readers in salesmanship, and did not think they would waste much time. He pointed out that there were hundreds of proprietary articles on the market which were distinctive in character, and the manufacturers of them could draft letters better than anybody else. He did not agree with the suggestion of fitting out shops free of charge. There were some well-lighted shops about, and he did not see why these should not be used as examples. As to his remarks upon the electrical Press, he had particularly said "some" papers. Even so, he thought that still more attention could be given to this vital subject by the electrical papers. The electrical Press had a tremendous responsibility, because it had it in its power to make or mar any particular part of the industry.

ELECTRIFICATION SCHEMES IN CZECHO-SLOVAKIA.

A Large Programme.

By W. LEAVIS.

The task of intensifying industrial production in Czecho-Slovakia and of placing the manufacture of goods on a cheaper basis has long since led to comprehensive plans on the part of the Government for the gradual electrification of the country. In recent years the scheme received a further stimulus through the separation of Czecho-Slovakia from the Galician oilfields, which necessitated an annual import of naphtha amounting to 500 million Czecho-Slovak crowns, and through the loss of some of the coalfields in Silesia, assigned to Poland. According to official information the limited funds at the disposal of the Government rendered it necessary to proceed cautiously, and although Moravia, Silesia, Slovakia, and Carpathian Ruthenia are eventually to benefit from the scheme, the immediate work is confined to Bohemia. Even here, the southern part, owing to different local conditions, will have to exercise patience until circumstances permit of its thorough participation in the scheme. South Bohemia, which comprises nearly one-third of the whole area, is comparatively poor and sparsely populated, while its industries are chiefly concentrated in the larger towns. The electrification of these districts is, therefore, of the utmost economic importance, but, as it would involve more extensive and costly work than in the other parts, a thorough application of the scheme will have to wait until the work in Northern and Central Bohemia is carried out, or, at least, more advanced.

The work of electrification in Bohemia is being pursued in two directions: the harnessing of water-power and the erection of steam generating stations, together with a network of distributing stations. The erection of hydro-electric power stations is being chiefly undertaken by the State in conjunction with the district authorities, assisted by individual municipalities and private undertakings. The electrification law, which was passed in the National Assembly some time ago, provides for this purpose a sum of 75 million crowns, which is to be apportioned to the budgets between 1919 and 1928, though about one-half of this amount has already been disbursed. Apart from this Government subsidy the district authorities, towns, co-operative societies, and private establishments, will bear a share of the outlay, in consideration of which electrical undertakings of public utility are granted certain expropriation rights, a rebate in rates and taxes, and other benefits. Up to the present 14 electrical undertakings of this kind have been founded.

The projects for opening up the Vltava to navigation between Prague and Melnik and the Labe from Melnik to the Saxonian frontier, and the execution of the respective works, have been entrusted to a commission for the canalisation of the two rivers. Two-thirds of the cost is borne by the State, and one-third by the district administration.

The work which has been actually started, or the execution of which is imminent, includes the following:—

A hydro-electric power station at Kralovstvi (on the Labe), with a maximum output of 6,400,000 kWh per annum, and at an estimated cost of five million crowns. This station is to be connected with the large transmission station of the East Bohemian electric station at Trutnov (30,000 volts).

A hydro-electric power station at Podebrady (on the Labe) with an annual output of 5,000,000 kWh which, by the aid of two transformers, will be transformed up to a pressure of 15,000 volts and fed into the network of the Central Labe districts at Kolin.

A hydro-electric power station at Nymburk (on the Labe) with an annual output of 5,000,000 kWh, transformed up to the same pressure, and similarly conducted as the foregoing.

Plans for the immediate future include hydro-electric stations at Prelouc and Smirice, with an output of 6,400,000 kWh per annum and of 5,000,000 kWh respectively.

The hydro-electric power station at Strekov is reckoned to produce 62,000,000 kWh per annum, and the estimated cost ranges in the neighbourhood of 300 million crowns.

On the Vltava a hydro-electric power station near Mirovice, on which work has already been started; maximum output 17,500,000 kWh per annum; estimated cost 32 million crowns. The plan for the erection of a hydro-electric power station near Troja has been abandoned in view of a larger programme.

Further, the technical department of the district administration has elaborated plans for the utilisation of the water-power of other rivers in Bohemia, and these have partly been put in hand or are awaiting realisation in the near future.

A hydro-electric power station near Spalov (on the Jizera) with a maximum annual output of 14,500,000 kWh, and at an estimated cost of 46,700,000 crowns. The work has already been started.

A hydro-electric power station near Sedlice (on the Zelivka), with an output of 6,000,000 kWh per annum, and at an estimated cost of 26,200,000 crowns. The current will be fed into the network of the South Bohemia Electricity Works at C. Budejovice.

A hydro-electric power station near Kaplice (on the Cerna), with an annual output of 6,000,000 kWh, and at an estimated cost of 9,000,000 crowns. The current to be distributed as above.

The river Sazara is to be utilised for electric power near Smrcena (6,000,000 kWh), near Privlsky (3,200,000 kWh), and near Kamenny Oujezd (8,000,000 kWh), the river Divoka Orlice near Litice (7,200,000 kWh), and the rivers Vydri and Kremelna at their most advantageous points.

Taking the total capacity of the electric installations in the southern districts of Bohemia, we find that it amounts to 4,580 kW, or 0.307 kW per square kilometre, as compared with an average of 2.6 kW per square kilometre if the whole of Bohemia is taken into account. For generating purposes, water-power, peat, and the cheaper kinds of coal enter into consideration. There is plenty of water-power in these parts of Bohemia, but its adaptation to electrical purposes will require both time and money. There is, first of all, the Vltava, which can be tapped at several places. On five points alone this river is capable of supplying about 200,000,000 kWh per annum. Considerable water-power might also be obtained by the utilisation of the rivers Otava, Luznice, Malse and Vydra, and work on some of these is already in progress. However, in view of the costly and lengthy proceedings which the opening-up of these sources would entail, the plans for the immediate future are restricted to smaller work, which lends itself to quicker and cheaper treatment. To this category belongs a hydro-electric station near Letosice, on the Vltava, which is estimated to produce about 6,000,000 kWh per annum. The construction of this station is in progress. Two other (smaller) stations are to be built near Smrena, on the Upper Sazava, and near Sedlice, on the Zelivka. The water-power of the river Cerna is also to be utilised.

All these hydro-electric stations must have some reserve power, and for this purpose the large peat and lignite fields of Southern Bohemia might be utilised.

The large central power station at Mydlovary, near C. Budejovice, in conjunction with smaller stations on the rivers Vydra, Zelivka, Smrcna, and Cerna, is intended to furnish South Bohemia with electrical energy. The erection of the station at Mydlovary, together with the outlying stations, as well as the exploitation of the water-power in South Bohemia, will be undertaken by the South Bohemian Electrical Co., of C. Budejovice. This undertaking has at its disposal an initial capital of 10,000,000 crowns, which is to be trebled in the near future.

The municipality of Kaaden has commenced the erection of a hydro-electric power station near Lametice, on the Ohre (Eger), with a maximum output of 35,000,000 kWh, and at an estimated outlay of 80,000,000 crowns.

The following works are to be built by corporations or private enterprise :—

A hydro-electric station near Letosice, on the Vltava, with an output of 6,000,000 kWh, the current—at a pressure of 22,000 volts—to be fed into the network of the South Bohemian Electrical Works.

A hydro-electric station near the Bretmercice Weir, on the Labe, with a capacity of 1,000 h.p.

On the Jizera (Iser) the engineering firm of Laurin and Klement is building several power stations, partly for its own use, and partly for the supply of the surrounding district. For instance, this firm has erected a small power station at Rozatov (370 h.p.), and another at Bakov (500 h.p.), while the utilisation of the water-power at Haskov is in contemplation.

A hydro-electric power station is in course of construction on the Rozemberk pond (which forms part of the Schwarzenberg estate), with utilisation of the river Luznice. The annual output of this station will be 3,000,000 kWh, the current—at 22,000 volts—to be fed into the network of the South Bohemian Electricity Works.

The systematic electrification of Bohemia is to be carried out by several large companies, which, later on, are to be amalgamated into a single concern. With this view, both the State and the district administrations are participating in the scheme, and lending every support in their power to the companies in existence or to be founded. In this way, shortly after the foundation of the Republic, the East Bohemian Electricity Works at Trutnov, together with the works at Poric, were taken over by the district authorities, and have since been enlarged. In 1919 these works had a maximum output of 18,500,000 kWh, while a year later this had risen to 22,100,000 kWh. With a view to the rational electrification of the Turnov district to the Eastern County border the Association of Consumers of Electric Energy at Hradec Kralove has been transformed into a large association of electrical works belonging to the districts, communities, co-operative societies, and other consumers of electrical energy at Hradec Kralove, and is now engaged upon the enlargement of the conducting network in the North-Eastern part of Bohemia.

The Association of Electrical Works of the Districts situated on the Middle-Elbe, at Kolin, a limited company, produced in 1919, 4,882,000 kWh, and in 1920, 5,385,281 kWh.

The hydro-electric power station at Drazice, which supplies the communities situated on the lower Jizera, produced in 1919 2,000,000 kWh, and in 1920, 2,500,000 kWh.

The Central Bohemian Electricity Works, Ltd., at Kolin, and the Association of Electricity Works of the Central Bohemian Districts, Ltd., at Prague, are co-operating concerns, of which the former has taken up the erection of power stations on the lower Vltava, between Prague and Melnik, while the latter is to supply twenty districts in Central Bohemia.

The Central Power Station at Reichenberg (Liberec), a limited company, is to undertake the enlargement of the electricity works (driven by steam) at Engelsberg. The central station furnishes power chiefly to the municipality of Reichenberg and the surrounding districts. In 1919 it produced 11,400,000 kWh.

The North Bohemian Electricity Co., at Bodenbach (Podmokly), supplies the northern part of Bohemia, and is enlarging its station (steam) at Trmice. In 1919 it produced 48,900,000 kWh, and in 1920 55,550,000 kWh.

The Association of Western Bohemian Electricity Works, Ltd., at Pilsen, has taken over the power station at Harova Brasy, whose production in 1919 was 340,000 kWh, and in 1920 850,000 kWh, while another large increase took place last year.

The above concerns comprise only those that are to form a basis for the electrification of Bohemia. Besides these, other electricity works and electrical undertakings have of late considerably enlarged their scope. At the end of 1918 the total length of the conducting networks of 30 of the larger power stations in Bohemia was 2,061 kilometres; by the end of 1920 these had been enlarged by 1,321 kilometres. While in 1918 these works had a capacity of 78,800 kW (steam) and 7,100 kW (water), this was increased by the end of 1920 by 50,800 steam and 2,940 water kW.

Considerable importance attaches to the supply of electricity to Central Bohemia, and, in particular, to the capital, Prague. The present installation is entirely insufficient, and a comprehensive scheme is to be put in operation. A large central power station is to be erected on the State-owned coalfield near Seestadtl with a capacity of 45,000 kW; further, a high-pressure hydro-electric power station of 75,000 kW with an average annual production of 350,000,000 kWh is to be built at Stechovice, on the Vltava, above Prague, and a low-pressure hydro-electric power station of 10,000 kW and a production of 41,000,000 kWh per annum near Vrane, also on the Vltava above Prague. These are to be connected with one another by a high-pressure line. The station at Seestadtl is to be completed within two, the hydro-electric station near Stechovice within six, and the one near Vrane within four years. These stations, which are to be formed into a joint stock company, will supply energy only in bulk, viz., to the electric works at Prague, to various associations of electricity works, and to other power stations, while the distribution of the current is left to the associations of electricity works, in so far as they do not make use of other generating stations.

The power station at Seestadtl, which at first will be equipped with two turbo-generators, will use the coal produced from the mine. As the necessary quantity of water is not available on the spot, a pipe, many kilometres long, is to be laid to a pumping station, situated near Twerschitz, on the river Eger. The main part of the electric power will be transformed to a pressure of 100,000 volts, which, by means of a transmission line 100 kilometres long, is to be conducted to Prague, while on the way, near Kladno, a large transforming station, for the supply of local industrial establishments, has been planned. The total cost of these installations is estimated at about 300,000,000 crowns, which is to be raised by a loan bearing interest at 9 per cent. per annum. This project is to be carried out by a joint stock company with an initial capital of 200,000,000 crowns, in which the municipality of Prague is to participate with 20 per cent., the State with 60 per cent., and the Province of Bohemia with the remainder. In this scheme the Ministry of Public Works proposes to connect the larger electricity works, situated in the lignite districts, with each other, and also with the central power station to be erected with a common connecting main, so that the whole installation will become part of a single system.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Western Centre Chairman's Address.

The opening meeting was held in Bristol on October 9th, when Mr. F. Tremain, the new chairman, delivered his inaugural address. There was a large attendance, and in the course of his speech Mr. Tremain explained that it was nearly forty years since he was elected a member of the Society of Telegraph Engineers and Electricians. As he had been prevented from attending the Institution Jubilee Commemorative Meetings, at which he was invited to speak, he enumerated some of the difficulties students experienced in the early days, soon after the passing of the Elementary Educational Act. The Chairman continued: I wonder if our captains of industry realise the tremendous potentialities of all the well-equipped engineering students who come to them from the technical colleges? I have an uneasy feeling that they are better utilised on the whole in other countries. We want more engineering research and some industrial psychology if this country is to hold its own in the application of electricity to the service of man. If our industrialists in the electrical field would only spend 1 per cent. of their net revenue in research work and propaganda I believe they would be rewarded a thousand-fold.

The progress made in the 17 years since I left London for Newcastle-upon-Tyne, on being appointed as superintending engineer, is certainly very remarkable. Electricity supply engineers have some leeway to make up if they are to progress as much in their art as telephone engineers have in theirs. Until they obtain a 24-hour load for their generating stations the capital expended on their generating plant, substations, mains, networks, and equipment cannot possibly earn a full and adequate return, so as to bring down the cost of energy to a competitive figure.

I was pleased to see in a recent local newspaper reference to a suggestion I have been making to supply engineers for several years. I refer to the supply of hot water for domestic purposes by the use of immersion heaters operated at night, when so much generating and other plant is, to a large extent, idle. Thermal storage is well worthy of industrial research. There are probably in Bristol alone, for instance, 80,000 30-gallon hot-water tanks out of use, due to the very extensive substitution of gas and electric cookers for the kitchen range. I suggest that if these were recovered and converted to lagged tanks, or otherwise made "thermproof," and fitted with heating elements, and such a valve as is fitted in gas and electric steam radiators for turning down the gas or cutting off the electricity when a temperature approaching boiling point is reached, an extremely valuable storage of energy would be provided. The electrical energy stored by two and a half million gallons of water raised 150 deg. F. in temperature is not to be despised. To compete with gas-

heated water electrical energy would probably have to be supplied at one-third of a penny per kWh. It might be worth a halfpenny in view of immunity from fire risks, but the fact that it can be controlled from a distance is an immense advantage, as is also the fact that it can be turned completely off, whereas thermostatically-controlled gas is only turned down.

My suggestion is that a simple vibrating relay be devised to cut the heaters into circuit, one for each tank, at the will of the switchboard attendants, district by district. This could probably be done by superimposing on the supply network a signalling current, which would possibly be sent over the network in certain areas in turn, so as to spread the supply for this purpose over the slack hours. In fact, if this plan is feasible, energy for this purpose could be supplied at any time of the day or night when spare energy happened to be available. The thermostat would cut out individual tanks when sufficiently heated. For bringing this stored hot water up to boiling point, necessitating the addition of cold water, and so conserving the supply, I would suggest the use of small super-heaters on each hot-water tap in a house.

As regards the insulation of the tanks, it might be practicable, now that aluminium is becoming cheaper and more plentiful, to provide an inner lining to existing tanks, on the thermos principle, exhausting sufficiently the space between the inner and outer walls. A recommendation for this system, if it can be successfully introduced, would be the fact that if hot water is not used, due to a day's absence from home, only the small leakage of heat would be made up and charged for, whilst during prolonged absence the supply should, of course, be cut off at the main switch.

Another utility suggestion might be worthy of industrial research and exploitation. We have heard of the superimposing of telephonic speech with the necessary calling facilities by ringing bells, &c., on transmission lines operated at 30,000 or even 110,000 volts. Now, of course, on underground power cables of any length or networks, speech probably could not be superimposed. The electrostatic capacity of such cables is too high, but signals of a moderate periodicity probably could, and there are buzzers on the market which operate at the supply frequency, and are intended to take the place of house-bells and their batteries. If a buzzer could be designed which would operate at this frequency and no lower I would suggest its use for waking people up instead of doing so by alarm clocks. If one could be made to operate at two frequencies a little above and two a little below, these frequencies could then be sent over the network at, say, half-hour intervals from 6 a.m. to 8 a.m., and the renter would be supplied with a small instrument, which he would plug in, or turn a pointer to the time on a dial, at which he wished to be called. If in a city the size of Bristol 50,000 renters of this service could be obtained at, say, 10s. a year, a very nice additional revenue would accrue to the supply company for a small expenditure of energy. Until we can get the "cheap and abundant" supply of electrical energy we hear so much about, but see so little of, we might try to increase the utility of what we have.

I will conclude with something in the nature of a vision: When I was in the North of England I erected for telephone purposes trunk lines of H-poles braced with iron rods and from 40 ft. to 60 ft. in height. One line from Shap through Penrith, Carlisle, and Gretna, to Scotland, and on the East Coast a second line from North Allerton through Bishop Auckland and Newcastle over the Cheviots to Jedburgh; south and north in other districts they proceeded into Lancashire and Yorkshire respectively, and both into Scotland. Now, Prof. Robertson, in his inaugural address a few years since, spoke of various ways of getting cheap power, and he suggested that the Clyde might be dammed. I have heard the Clyde anathematised—and perhaps there is some reason for it when one is on it for pleasure—but if its great tidal energy could be converted and sent south over these lines, which I suppose the Post Office will not require when it can provide trunk lines underground—it should be possible to supply energy without undue expense to Manchester and Lancashire in general, as well as to the East Coast and Yorkshire. There are also the poles and the lines to every town and village in the country, and my dream is that nearly all overhead plant of this kind will in the future be used for power transmission. Much thicker conductors would have to be employed in some cases, but only in a few of them, and the total weight and strain on the poles would probably be much less than at present. The Shap-Carlisle line probably carried four tons of copper to the mile. On the minor cross-country lines energy for lighting and power could be conveyed to every town and village. Over these minor lines it will, no doubt, be possible to provide the telephone service by means of high-frequency carrier currents, or by means of telephone cables suspended on the poles when the latter are used for power transmission. This double utility should cheapen both services, and might lead to the repopulation of our rural districts, reviving their industries, and greatly increasing the amenities of country life.

No doubt main lines all over the country would similarly become available for other than their original purpose. The turn of the tide of population, at least in part, back from our great centres to the smaller towns and villages would undoubtedly help towards the greatest happiness to the greatest number. The increased modern facilities for travel will also help this, but nothing so much as the widespread provision of cheap electrical energy for light and power, and the revival of rural industries.

THE NEW B.L.I.C. MAGNETO.

ROTATING MAGNET TYPE.

It will be recalled that in order to assist in meeting the enormous demands for magnetos that arose when it was realised that mechanical transport was one of the essential factors in war operations, the British Lighting & Ignition Co., Ltd. (proprietors: Vickers, Ltd.), commenced the manufacture of magnetos in this country during the early part of the European war. It was appreciated, however, that the pattern then produced had by no means reached finality, and Mr. E. O. Turner, the firm's chief electrical engineer, therefore set himself the task of evolving a new design, and Mr. B. Callard, managing director, is to be congratulated on his firm's achievement.

The form of construction employed is almost the inverse of that adopted in the older type of rotating-armature machines with which all motorists are familiar. In the new B.L.I.C. magneto, fig. 1, the magnet, the most robust part of the machine, is made to rotate, while the armature, with its low- and high-pressure windings, remains stationary. All fragile insulated parts, such as slip rings, lengthy rotating brush holders, collector brush holders, and so on, have, by careful design, been entirely done away with. In their place is a short stationary connector piece (fig. 2) leading the high-pressure current from the stationary armature to the stationary distributor terminal; this arrangement is so great an improvement as practically to prevent, it is claimed, the possibility of breakdown.

The contact breaker is of an improved pattern, and is also stationary, the cam being revolved instead; this not only enables the sticking contact breaker lever—a trouble which so many motorists have experienced in the past—to be entirely eliminated, but enables a much more robust unit to be made, requiring less attention either for cleaning or for resetting the contacts.

Fig. 2 shows two sectional views of a standard G.4.-R. type magneto, and fig. 3 shows in diagrammatic form its connections. The path of the flux from the N pole of the magnet F, through the stator pole shoe N, armature core A, and back through the right hand stator pole shoe to the S pole of the magnet, may be followed from the right hand

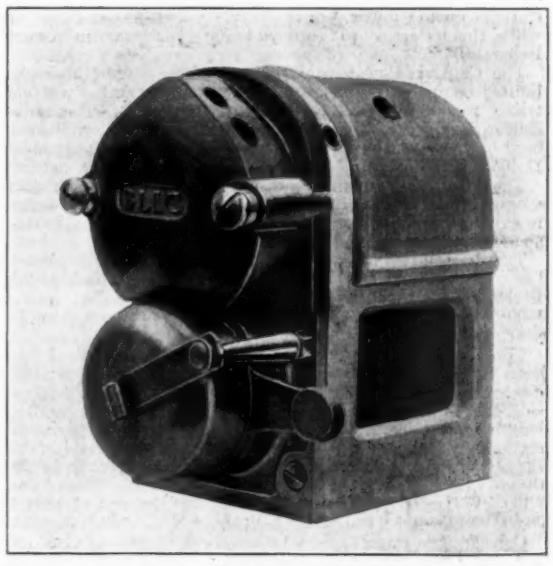

Fig. 1.—The New B.L.I.C. Magneto.

drawing in fig. 2. Referring to the left hand view in fig. 2, the armature core A carries two windings: B, the low pressure and C, the high pressure. One end of the l.p. winding is connected to the earthed moving point of the contact breaker, and the other end to the stationary insulated point. The start of the h.p. winding is connected to the end of the l.p. winding and the end of the h.p. winding to the connecting piece D. A condenser E across the contact points prevents sparking taking place when the primary current is interrupted. On turning the rotor F with the contact breaker points separated a voltage is induced in both windings; this pressure, however, is generally too small to produce a spark at the plug points. When the rotor is turned with the contact points closed a current flows in the primary winding, its effect being to delay the decay of the

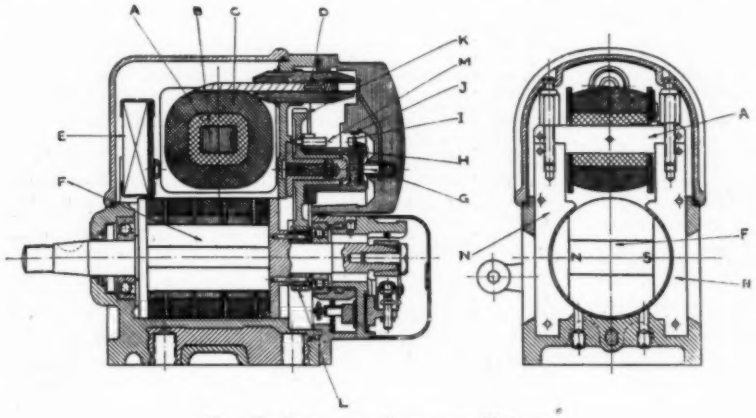

Fig. 2.—Sectional Views of Magneto.

magnetic flux. If, now, at a suitable position of the rotor the contact points are made to open, the armature current being near its maximum value, the flux threading the primary winding will change suddenly and will cut the secondary winding with great rapidity, producing the high voltage necessary to jump the sparking plug gap. The most suitable position to open the points is found to be when the trailing tips of the rotor have left the armature pole shoes by a few millimetres. The h.p. current so generated is led from the armature through the connecting piece D to the centre brush on the distributor G; thence by means of the rotating arm H and its brush I it passes to the brass segments J of the distributor, to which the plugs are connected.

Since the primary current in the armature is a maximum twice during each revolution, it is possible to obtain two sparks per revolution; a 4-cylinder magneto, therefore, runs at engine speed in order to produce four sparks during the two revolutions of the engine.

The distributor brush arm is mounted on a gear wheel K, which is driven from the rotor by means of another gear wheel, L. The distributor runs at half engine speed, since

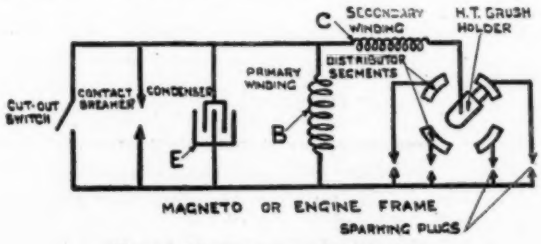

Fig. 3.—Diagram of Connections.

it has to complete one revolution during two revolutions of the engine. The cut-out device consists of an insulated terminal connected to the insulated end of the primary winding. If the earthing wire is connected to this terminal, on closing the switch the contact breaker is short-circuited, thus rendering the magneto inoperative. Reference to fig. 3 will make this clear. The safety spark gap is shown at M (fig. 2). If the h.p. circuit were broken, either through any of the cables becoming detached from the plugs, or from any other cause, the spark would occur between the serrated pins, thus protecting the insulation of the machine from excessive strain.

The chief component parts of the magneto are shown in the illustration of a partially dismantled machine seen in fig. 4.

It has been possible to supersede the old design because use has been made of a cobalt steel magnet, the superiority of which over tungsten steel is so great that the new magnet is only about 1/6 the size of the discarded one. The result is that the new product is very compact. The dimensions are far below the maximum limits prescribed by the British Engineering Standards Association, and the machines are also very light; for example, a magneto for a medium size 4-cylinder engine weighs only 6¼ lb., as against 15 lb. for the superseded model. The cycle pattern weighs about 3½ lb., as against 8 lb. The new models will spark satisfactorily at speeds of between 50 and 60 r.p.m., below which it is not necessary to go as effective carburation is not obtainable at lower speed than that.

The armature being stationary enables much more thorough provision for insulation to be made and on this account it does not "weaken" with age, and rotating h.p. windings, condensers, connections, &c.—hitherto regarded as necessary evils—have in consequence been swept away for good. There are no fragile insulated parts: the old slip rings, brush holders, pick-ups, and rotating pieces have been superseded by a single, short, stationary connector piece between the armature and the distributor. This feature ensures increased reliability as well as greater simplicity.

The magnetic structure is effectively laminated, the fan-shaped stationary pole-shoes, and the construction of the rotor shoes, bring about superior lamination of the magnetic structure; this arrangement is largely responsible for the excellent sparking characteristics of the machines notwithstanding their light weight.

Since the contact breaker is stationary—the interruptions being caused by the cam, which revolves with the magnet—the contact opening is not affected by wear to so great an extent as the older type. There is only one rubbing carbon brush, in place of the five or more employed in the older type of machine. The heel piece, lever arm, and pivot brush, together with a miniature reservoir of grease for lubricating the pivot, are formed in a single element, consisting of bakelite-dilecto laminæ; this arrangement eliminates the sticking contact lever, and a laminated gear wheel damps out the ringing sound which the impulsive

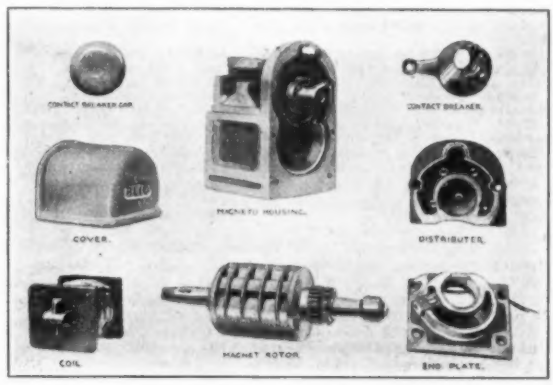

Fig. 4.—Component Parts of Magneto.

drive of the magneto induces in solid metal wheels, and ensures quiet running at all speeds.

All types of the new magneto are watertight and dustproof, and are covered by a twelve months' guarantee for perfect running.

The Volta Electric Furnace.—The first installation in Great Britain of the new Volta electric steel furnace, made by the Volta Manufacturing Co., Ltd., of Ontario, Canada, is to be at the works of Messrs. Renton & Fisher, of Bathgate, Scotland, who have ordered one of three tons capacity. Messrs. T. Rowlands & Co., Ltd., of Sheffield, are the agents in Great Britain for this furnace, says the *Sheffield Daily Telegraph*.

A Large Flood-lighted Sign.—The sign erected by the British Thomson-Houston Co., Ltd., at its Rugby works, indicating that "Mazda" lamps are made there, is the largest of its kind in this country. It measures 33 ft. by 22 ft., and consists of opal-glass faced letters on a steel framework bolted to the factory roof. The initial letter "M" is 11 ft. in height. To convert this into an ordinary electric sign would require at least 800 ten-watt lamps, representing a load of 8 kW. By the B.T.H. flood-lighting method only half this power is required, *viz.*, four 1,000-W "Mazda" gas-filled lamps.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

26,478. "Lighting and heating." A. E. Muirhead, J. G. Muirhead, and M. A. Muirhead. October 2nd.
26,482. "Carbon-holder for projection arc lamps." J. B. Grocutt. October 2nd.
26,485. "Head lights, &c." W. A. Cooke and F. H. Moody. October 2nd.
26,487. "Means for regulating supply of liquid from cistern to electrolytic apparatus." E. Reuss and V. Roberts. October 2nd.
26,489. "Electric hand lamps." S. R. Berrisford. October 2nd.
26,506. "Electrically-driven valve-grinding machines." Campbell & Isherwood, Ltd., and G. H. Rae. October 2nd.
26,528. "Electrical advertising and illuminating devices." E. V. Hayes-Gratze. October 2nd.
26,529. "Devices for regulating voltage of dynamos." Eclairage des Vehicules sur Rail. October 2nd. (France, October 3rd, 1921.)
26,537. "Recording attachment for standard telephone sets." B. S. Tharp. October 2nd.
26,547. "Electric lock and indicator." E. Dwyer and W. Dwyer. October 2nd.
26,552. "Switch drums for starting and controlling electromotors." F. Krupp Akt. Ges. October 2nd. (Germany, October 4th, 1921.)
26,569. "Sound amplifiers." C. J. Dodge. October 2nd.
26,573. "Electric plug contact." Progress Akt. Ges. October 2nd. (Switzerland, September 30th, 1921.)
26,584. "Passing electric current through petrol." W. L. Morgan. October 2nd.
26,587. "Wireless apparatus." W. F. Hurndall. October 2nd.
26,596. "Rotor winding for asynchronous motors without starters." C. Shenfer. October 2nd.
26,432. "Wireless receiving apparatus." British Thomson-Houston Co., Ltd., and R. C. Clinker. September 30th.
26,434. "Attachment for talking machines, wireless apparatus, &c." E. A. Sibthorpe. September 30th.
26,447. "Saddle, &c., clamps for sheathed electric conductors." A. Kirk and R. C. Milliken. September 30th.
26,450. "Transformers for wireless apparatus." C. W. Clarabut, A. H. Curtis, and Igranic Electric Co., Ltd. September 30th.
26,451. "Frame aerials." C. W. Clarabut, A. H. Curtis, and Igranic Electric Co., Ltd. September 30th.
26,452. "Inductance coils for wireless receiving apparatus." A. H. Curtis, Igranic Electric Co., Ltd., and S. R. Wright. September 30th.
26,472. "Coil-holder for wireless receiving sets." W. W. Nicoll. September 30th.
26,474. "Wireless receiving systems." C. B. Guest and F. E. Guest. September 30th.
26,602. "Ignition devices for explosion motors." E. von Lepel. October 2nd. (Germany, October 6th, 1921.)
26,604. "Electric conductor terminals." British Thomson-Houston Co., Ltd. (General Electric Co.). October 2nd.
26,609. "Insulators for suspended high-tension wires." A. Renaudin. October 2nd. (France, October 3rd, 1921.)
26,611. "External spark-gaps for internal-combustion engines." J. Robinson and J. B. Wright. October 2nd.
26,638. "Wireless telegraph apparatus." T. Houghton and F. W. Longworth. October 3rd.
26,658. "Clips and terminals for electric leads." S. W. Bussell. October 3rd.
26,673. "Rectifying devices." A. R. Angus. October 3rd.
26,678. "Measured service devices for automatic telephone systems." J. H. Jones. October 3rd.
26,679. "Measured service devices for automatic telephone systems." J. H. Jones. October 3rd.
26,682. "Axles for electrically-driven road vehicles." H. M. Butler. October 3rd.
26,692. "Electrical systems and apparatus for chemical treatment of non-conducting liquids." W. McMullen and W. J. Ricketts. October 3rd.
26,695. "Ironclad electric switches." A. Willmott. October 3rd.
26,696. "Electric condensers." L. von Kramolin. October 3rd. (Germany, July 10th.)
26,707. "Variable condensers." M. V. Pirie. October 3rd.
26,711. "Electric switches." J. P. Haworth. October 3rd.
26,719. "Telephone, &c., head-pieces." R. F. Tunmer. October 3rd.
26,724. "Radio adaptor." W. B. Medlam and C. H. Stave. October 3rd.
26,734. "Arrangement for regulating speed of alternating-current motors." N. Japolsky and M. Kostenko. October 3rd.
26,744. "Microphonic transmitters." E. A. Graham. October 3rd.
26,745. "Combined gramophone and telephonic apparatus for use with wireless telephonic apparatus." E. A. Graham. October 3rd.
26,753. "Magneto inner ball race remover." A. C. Abel. October 4th.
26,765. "Electric motors." N. W. Bairstowe. October 4th.
26,766. "Electric motors." N. W. Bairstowe. October 4th.
26,790. "Electric clock." A. B. Härje. October 4th.
26,806. "Adjustable electric resistances." H. V. Albrow. October 4th.
26,808. "Method of telephonic communication on fire alarm systems." E. E. Moore. October 4th.
26,818. "Electric welding apparatus." A. E. Cutler and P. A. Marsden. October 4th.
26,819. "Electric welding apparatus." A. E. Cutler and P. A. Marsden. October 4th.
26,831. "Dynamo-magneto units for lighting and ignition in motor vehicles." Scintilla. October 4th. (Switzerland, October 4th, 1921.)
26,832. "Sparking plugs." R. E. Aqudio. October 4th. (Italy, November 26th, 1921.)
26,838. "Insulating materials." Metropolitan-Vickers Electrical Co., Ltd., and N. E. North. October 4th.
26,839. "Dynamo-electric machines." Metropolitan-Vickers Electrical Co., Ltd., and G. M. Pestarini. October 4th.
26,842. "Thermionic valve circuits." P. W. Willans. October 4th.
26,843. "Galvanic cells and batteries." F. Fischer and R. Pörscke. October 4th.
26,844. "Galvanic cells and batteries." F. Fischer and R. Pörscke. October 4th.
26,849. "Projection lamps." H. Workman. October 4th.
26,850. "Head-lights for motor vehicles." M. J. Williams. October 4th.
26,852. "Electric gas lamp." G. F. Dobinson. October 4th.
26,857. "X-ray apparatus." British Thomson-Houston Co., Ltd. October 4th. (United States, October 10th, 1921.)
26,859. "Conductor rails, and covers therefor, for electric railways, &c." Siluminite Insulator Co., Ltd., and E. V. Wythes. October 4th.
26,866. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 4th. (United States, January 27th.)
26,868. "Carbon-holder for arc lamps having rotary carbons." Anciens Etablissements Barbier, Benard et Turenne Soc. Anon. October 4th. (France, August 23rd.)
26,898. "Motor-car head lights, street lamps, &c." H. J. Sherborne. October 5th.
26,905. "Electric arc furnaces." V. Stobie. October 5th.
26,921. "Electric controllers." J. Munn. October 5th.
26,927. "Electric primary batteries." E. E. Dutt. October 5th.
26,928. "Electric storage batteries." E. E. Dutt and S. H. Godfrey. October 5th.
26,929. "Electric batteries." E. E. Dutt and S. H. Godfrey. October 5th.
26,937. "Ignition device for internal-combustion engines." G. W. Corless. October 5th.
26,969. "Stands for adjustably supporting X-ray tubes." J. B. Bower. October 5th.
26,970. "Selective switching apparatus." J. B. Bower. October 5th.
26,972. "Wireless receiving apparatus." R. C. Congdon and P. L. G. Johnston. October 5th.
26,980. "Telephone receivers." British Thomson-Houston Co., Ltd., and A. P. Young. October 5th.
26,986. "Sparking plugs." R. Colin. October 5th.
26,990. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. October 5th. (United States, February 11th.)
27,000. "Electro-magnets." H. J. Norballe. October 5th.
27,001. "Electric discharge tubes." Naamlooze Vennootschap Philips Gloeilampen Fabrieken. October 5th.
27,006. "Distillation of zinc, &c., by electrical means." F. J. C. Jones. October 6th.
27,011. "Suspension or connection device for electric fittings, &c." A. N. Haddow and A. P. Rutherford. October 6th.
27,016. "Electric traction systems." E. M. Munro. October 6th.
27,020. "Electric switches." O. W. H. Page. October 6th.
27,021. "Head-lights of vehicles." C. J. Witherspoon. October 6th.
27,039. "Power transmitters." W. Fairweather (Singer Manufacturing Co.). October 6th.
27,041. "Electrical device for external bolting of railway-carriage doors." G. E. Skinner. October 6th.
27,050. "Derailed tram adjuster." J. Davies and E. M. White. October 6th.
27,068. "Electric furnaces." L. J. Hancock and T. R. Hancock. October 6th.
27,070. "Protectors for connecting ligatures of suspended insulators" A. Renaudin. October 2nd.
27,071. "Suspending aerial electric conductors." A. Renaudin. October 6th. (France, October 8th, 1921.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1921.

10,339. "Apparatus for regulating the phase-compensation of synchronous electric machines by means of commutator machines connected in cascade with the rotor circuits thereof." E. C. R. Marks (Siemens-Schuckertwerke Ges.). April 8th, 1921. (186,057.)
10,585. "Apparatus for regulating the speed and phase-compensation of asynchronous electric machines by means of a commutator machine connected in cascade therewith." E. C. R. Marks (Siemens-Schuckertwerke Ges.). April 11th, 1921. (186,088.)
11,192. "Fusible safety cut-out for electric motors." B. Platschick. April 18th, 1921. (186,091.)
11,700. "High-frequency telephone transmitters." R. B. Ransford (Naamlooze Vennootschap Nederlandsche Radio-Industrie). April 22nd, 1921. (186,094.)
16,011. "Electric switches." P. B. Handley. June 10th, 1921. (186,108.)
16,425. "Electric resistances." S. G. Frost. June 15th, 1921. (186,117.)
16,639. "Means for producing alternating electric currents." H. J. Round. June 16th, 1921. (186,129.)
16,799. "Means for indicating the period of and/or controlling electrical oscillations." A. M. Young and N. W. Simpson. June 18th, 1921. (186,134.)
16,874. "Utilisation of surplus power from hydro-electric plant for the preparation of peat or similar fuel." N. Testrup and Techno-Chemical Laboratories, Ltd. June 20th, 1921. (186,137.)
16,879. "Thermionic signal-receiving systems." British Thomson-Houston Co., Ltd. (General Electric Co.). June 20th, 1921. (186,138.)
16,882. "Apparatus for separating or sorting fragmentary materials by electric conductivity." H. L. A. Schweitzer. June 18th, 1920. (Patent of addition not granted.) (165,098.)
16,888. "Terminal connections for electric wires." Dr. A. H. Mollik and Merz-Werke (Geb. Merz). October 11th, 1920. (170,266.)
16,907. "Automatic telephone exchanges." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. June 20th, 1921. (186,141.)
17,024. "Ignition devices for internal-combustion engines." C. Pressland. June 21st, 1921. (Cognate application, 32,845/21.) (186,155.)
17,045. "Surgical illuminating and optical appliances." W. P. Reaves. June 21st, 1921. (186,158.)
18,982. "Electric lighting and heating system for railway and the like vehicles." A. Spencer. July 13th, 1921. (186,194.)
19,070. "Electric-wave filter." Western Electric Co., Ltd. (Western Electric Co., Inc.). July 14th, 1921. (186,198.)
20,369. "Electric horns." W. J. Spicer and T. S. Rogers. July 29th, 1921. (186,211.)
20,790. "Antennæ system for wireless signalling." Ges. für Drahtlose Telegraphie. August 6th, 1920. (167,490.)
20,972. "Contact device for electrical telegraph transmitters." H. J. Haneen. August 8th, 1921. (186,219.)
21,120. "Thermally-controlled electric-circuit interrupters." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 9th, 1921. (186,221.)
21,681. "Electrical plug and socket connections or couplings." J. A. Crabtree. August 16th, 1921. (186,226.)
22,722. "Electric and gas fires." H. H. Berry. August 26th, 1921. (186,234.)
22,858. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. August 29th, 1921. (177,130.)
23,004. "Alternating-current track signalling." L. H. Peter and Westinghouse Brake and Saxby Signal Co., Ltd. August 30th, 1921. (186,239.)
23,069. "Motor-car or like lamps." E. A. Orr. August 31st, 1921. (186,240.)
23,321. "Electrical connectors and terminal blocks." W. Fairweather (Singer Manufacturing Co.). September 2nd, 1921. (186,245.)
26,307. "Combined electric switches and fuses." Phi-Kappa Syndicate, Ltd., and J. J. J. M. Kluijtmans. October 5th, 1921. (186,256.)
27,058. "Casings for transformers and other electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). October 12th, 1921. (186,259.)
33,151. "Apparatus for electrically precipitating suspended particles from fluids." Siemens-Schuckertwerke Ges. January 4th, 1921. (174,046.)
34,053. "Oil switches." Sachsenwerk Licht und Kraft Akt. Ges. December 17th, 1920. (172,982.)

1922.

8,211. "Electrical insulators." Metropolitan-Vickers Electrical Co., Ltd. (Railway and Industrial Engineering Co.). March 21st, 1922. (186,285.)
8,904. "Braking systems for dynamo-electric machines." British Thomson-Houston Co., Ltd. (Compagnie Française Thomson-Houston). March 28th, 1922. (186,286.)
10,677. "Apparatus for preventing the unauthorised operation of electric appliances on motor vehicles." Scintilla (firm of). May 20th, 1921. (180,307.)